

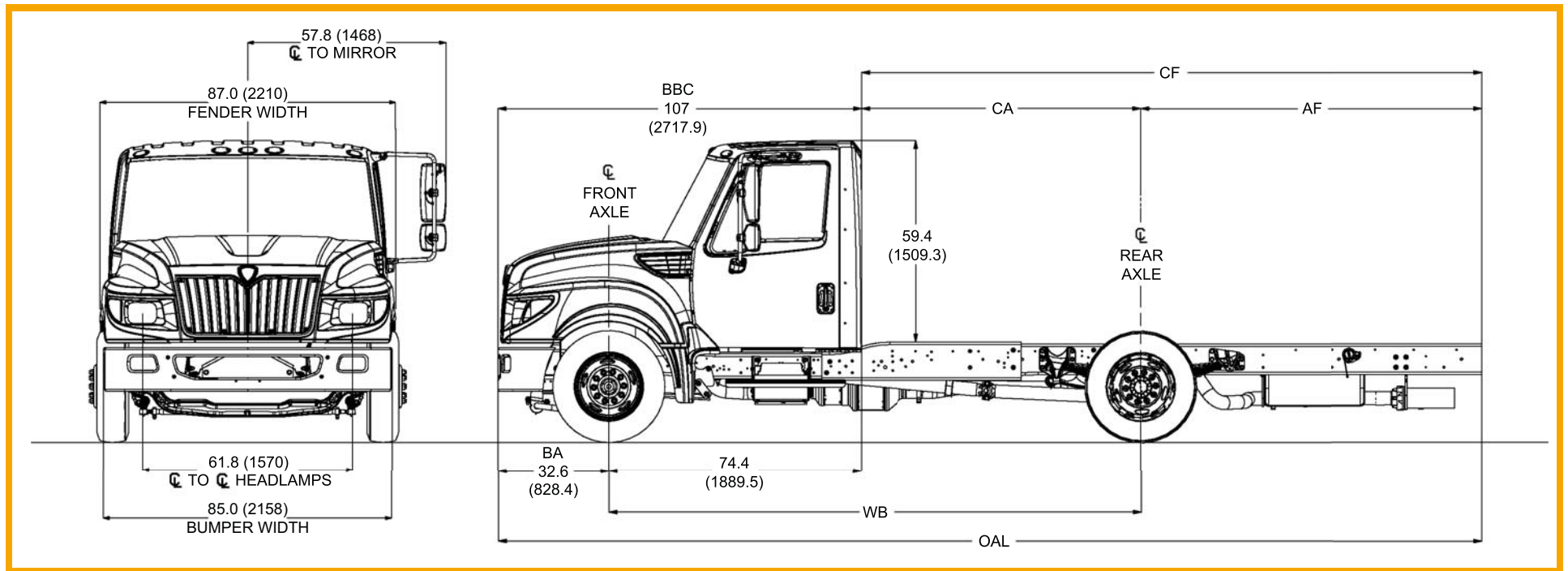


A NAVISTAR COMPANY

# 2011 BODY BUILDER

PBB-39100

(October, 2011 Edition)



## UC Commercial Bus

Cutaway Bus Chassis Body Builder

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Cab

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## PREFACE

### FOREWORD

The UC Commercial Bus – Cutaway Bus Chassis Body Builder contains information related to the features and specifications for the UC Commercial Bus product line.

#### Disclaimer

The Body Builder Book provides product information to assist those who wish to modify these products for individual applications. Navistar, Inc. does not recommend or approve any firm or party nor make any judgements on the quality of the work performed by a particular firm or party. Individuals who use the services of a Body Builder must satisfy themselves as to the quality of the work.

The party installing a body, any other equipment, or making any modifications to complete the vehicle for delivery and make it road-ready is responsible to see that the completed vehicle complies with all applicable certification procedures and safety standards, as may be set forth in Federal, State, and local statutes, rules and regulations.

Specifications, descriptions and illustrative material in this literature are as accurate as known at time of publication but are subject to change without notice. Navistar, Inc. cannot accept responsibility for typographical errors which may have occurred. Illustrations are not always to scale and may include optional equipment and accessories but may not include all standard equipment.

IC Bus™ is a trademark of International Truck and Engine Corporation.

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PUBLICATION ORDERING INFORMATION

You can easily order UC Commercial Bus – Cutaway Bus Chassis Body Builder or Diamond Logic® Control Systems books by accessing the Marketing Resource Center and clicking the “Order Literature” link, using your regular User ID and password.

Revisions to the following product publications are available automatically by subscribing to the Product Information Revision Service. Also, additional copies of product publications can be ordered individually on a one-time basis. When ordering, include the publication number, description and quantity required.

<b>UC Commercial Bus:</b> Cutaway Bus Chassis Body	
Builder Diagrams .....	<b>PBB-39100</b>
<b>Diamond Logic® Control Systems</b> .....	<b>PBB-71000</b>

## GOVERNMENT REQUIREMENTS

### Your Obligations Under The Law

The important information in this section will acquaint you with U.S. and Canadian safety and emission standards that apply to Navistar, Inc. vehicles sold in the two countries, of those laws that established these standards, and the identity of the parties responsible for certification of compliance for both **Complete Vehicles** and **Incomplete Vehicles**. To the best of International's knowledge, it is correct as of the date of this printing. International, however cannot accept responsibility for it's completeness and currency. User must ascertain this on his own.

The National Traffic and Motor Vehicle Safety Act of 1966, in the U.S., gave rise to the Federal Motor Vehicle Safety Standards (FMVSS). In addition, The Environmental Protection Agency, through the Environmental Policy Act of 1969, set forth environmental protection standards.

In Canada, the Motor Vehicle Safety Act of 1970 established the Canadian Motor Vehicle Safety Standards (CMVSS) Act.

These standards place the responsibility for compliance of a **Complete Vehicle** on the vehicle and engine manufacturers. Any vehicle purchased from International, as a **Complete Vehicle** as defined by section 568.3 of Title 49 of the Code of Federal Regulations (CFR) is certified by International to comply with all applicable safety standards provided modifications or additions to the vehicle do not result in non-compliance with applicable U.S. and Canadian standards to which Navistar, Inc. has certified compliance. Also, it is the responsibility of every International dealer to assure that the service work or modifications that can affect compliance, performed on a new vehicle prior to delivery to the customer, meets the requirements specified by all mandated standards.

It is the responsibility of the Final-Stage Manufacturer who typically installs a body or other equipment, or makes any modifications to an **Incomplete Vehicle** supplied by International to certify compliance with the applicable standards for the vehicle when completed. Further, it is the responsibility of the Final-Stage Manufacturer to determine, and fully comply with, any additional requirements of the several States and Provinces. In addition, the Final-Stage Manufacturer must certify compliance with any other standards set forth in U.S. and Canadian regulations, statutes and ordinances.

### Penalties For Violations

Violation of the provisions contained within the U.S. Federal Motor Vehicle Safety Standards is subject to fines of up to \$5,000 per vehicle or up to a maximum of \$15,000,000. The following violations are subject to these penalties:

1. Any manufacturer who knowingly or unknowingly produces for sale a motor vehicle subject to the law, but which does not meet all the applicable provisions of the law.

2. Any party who sells or offers for sale a motor vehicle built after the effective date of a standard, which in the knowledge of the selling party does not comply with the standard.
3. Any party (manufacturer, dealer, body builder or other) who completes a vehicle for sale in compliance with the law but fails to certify the completed vehicle in the prescribed manner.
4. Any party who knowingly certifies a vehicle as complying, which does not in fact meet the requirements of the law.

Situations where the government was intentionally misled in regards to safety related defects are criminal violations and are punishable by a maximum of 15 years in prison.

The U.S. Department of Transportation has declared its intent to institute procedures periodically to inspect vehicles subject to the law, and to implement enforcement procedures that will permit detection of violations.

The requirements of the law are stringent and the penalties for violation are severe. It is therefore mandatory that all personnel involved in any of the following aspects of motor vehicles become familiar with the provisions of the law as they relate to their responsibilities.

- Installation of equipment sub-assemblies and/or bodies (Intermediate and Final Stage Manufacturer)
- Sales
- Preparation for delivery
- Modification or conversion (Alterer)
- Maintenance and repair

Violation of the Canada Motor Vehicle Safety Standards law carries similar penalties.

**NOTE:** The Canadian, Mexican, and U.S. vehicle standards, which regulate the manufacture of vehicles for sale in their respective countries, may at any time exceed all or a portion of the mandated requirements of one or both of the other two countries. This situation exists due to established standards or regulatory revisions in one country, which have not yet been incorporated by the other(s).

Each of these countries require that any vehicle crossing its border(s) in commerce must comply with all applicable standards of their country and comply with the standards that were in effect as of the date of manufacture of that vehicle.

## Federal Motor Vehicle Standards (FMVSS) and Canadian Motor Vehicle Safety Standards (CMVSS)

The following standards of Title 49 of the CFR apply to all liquid fueled vehicles having a GVWR greater than 10,000 pounds. Presently, all IC Bus™ trucks and buses are powered with diesel engines and have been designed to have a GVWR of greater than 10,000 pounds.

For any vehicle manufactured by and purchased from International and defined by section 567.3 of Title 49 of the CFR as an Incomplete Vehicle, consult the Incomplete Vehicle Document (IVD) provided with each Incomplete Vehicle to determine those particular safety standards with which the vehicle complies. Any standards, with which International cannot certify compliance because of the level of completion of that vehicle, become the responsibility of the Intermediate Manufacturer or Final-Stage Manufacture or both.

Table 1.1

FMVSS/CMVSS NUMBER	SUBJECT	TYPE OF CONFORMANCE*		
		TYPE 1	TYPE 2	TYPE 3
101	Controls, Telltales, and Indicators	X	-	-
102	Transmission Shift Lever Sequence, Starter Interlock, and Transmission Braking Effect	X	-	-
103	Windshield Defrosting and Defogging Systems	X	-	-
104	Windshield Wiping and Washing Systems	X	-	-
105	Hydraulic and Electric Brake Systems	-	X	-
106	Brake Hoses	X	-	-
108	Lamps, Reflective Devices, and Associated Equipment	-	X	-
111	Rearview Mirrors	-	X	-
113	Hood Latch System	X	-	-
115	Vehicle Identification Number	X	-	-
116	Motor Vehicle Brake Fluids	X	-	-
119	New Pneumatic Tires for Vehicles Other Than Passenger Cars	X	-	-
120	Tire Selection and Rims for Motor Vehicles with a GVWR of more than 4,536 kg (10,000 lbs.)	X	-	-
121	Air Brake Systems	-	X	-
124	Accelerator Control Systems	X	-	-

Table 1.1

FMVSS/CMVSS NUMBER	SUBJECT	TYPE OF CONFORMANCE*		
		TYPE 1	TYPE 2	TYPE 3
205	Glazing Materials	X	-	-
207	Seating Systems	-	-	X
208	Occupant Crash Protection	X	-	-
209	Seat Belt Assemblies	X	-	-
210	Seat Belt Assembly Anchorages	-	-	X
217	Bus Emergency Exits and Window Retention and Release	-	-	X
302	Flammability of Interior Materials	X	-	-
404	Platform Lift Installations in Motor Vehicles	-	-	X
1106	Noise Emissions	-	-	X

\*Type of Conformance:

Type 1: The vehicle, when completed, will conform to the standard if no alterations are made to the identified components.

Type 2: The vehicle, when completed, will conform to the standard if the specific conditions of final manufacture are met.

Type 3: Conformance with the standard cannot be determined based upon the components supplied on the vehicle therefore Navistar, Inc. makes no representation as the conformity of the vehicle to the standard.

## Additional Lighting Information

### Lighting Devices and Reflectors Required by FMVSS 108 and CMVSS 108

Table 1.2

#### Required Vehicle Lighting Equipment for Buses with an Overall Width of 80 inches or more

REQUIRED LIGHTING EQUIPMENT	QUANTITY	COLOR	LOCATION	POSITION	HEIGHT ABOVE ROAD SURFACE (In inches measured from the center of the lamp on vehicle at curb height.)
Headlamps	2 at least	White	Front	On the front at the same height, an equal number at each side of the vertical centerline as far apart as practicable.	Not less than 22 or more than 54.
Turn signal (Front)	2	Amber	At or near front	One on each side of the vertical centerline at the same height and as far apart as practicable.	Not less than 15 or more than 83.
Identification Lamp (Front)	3	Amber	Front	As close as practicable to the vertical centerline of the vehicle or the vertical centerline of the cab where different from the centerline of the vehicle.	All three on same level as close as practicable to the top of the vehicle with lamp centers spaced not less than 6 inches or more than 12 inches apart.
Tail Lamp	2	Red	Rear	One lamp each side of the vertical centerline at the same height and as far apart as practicable.	Both on the same level between 15 and 72.

Table 1.2

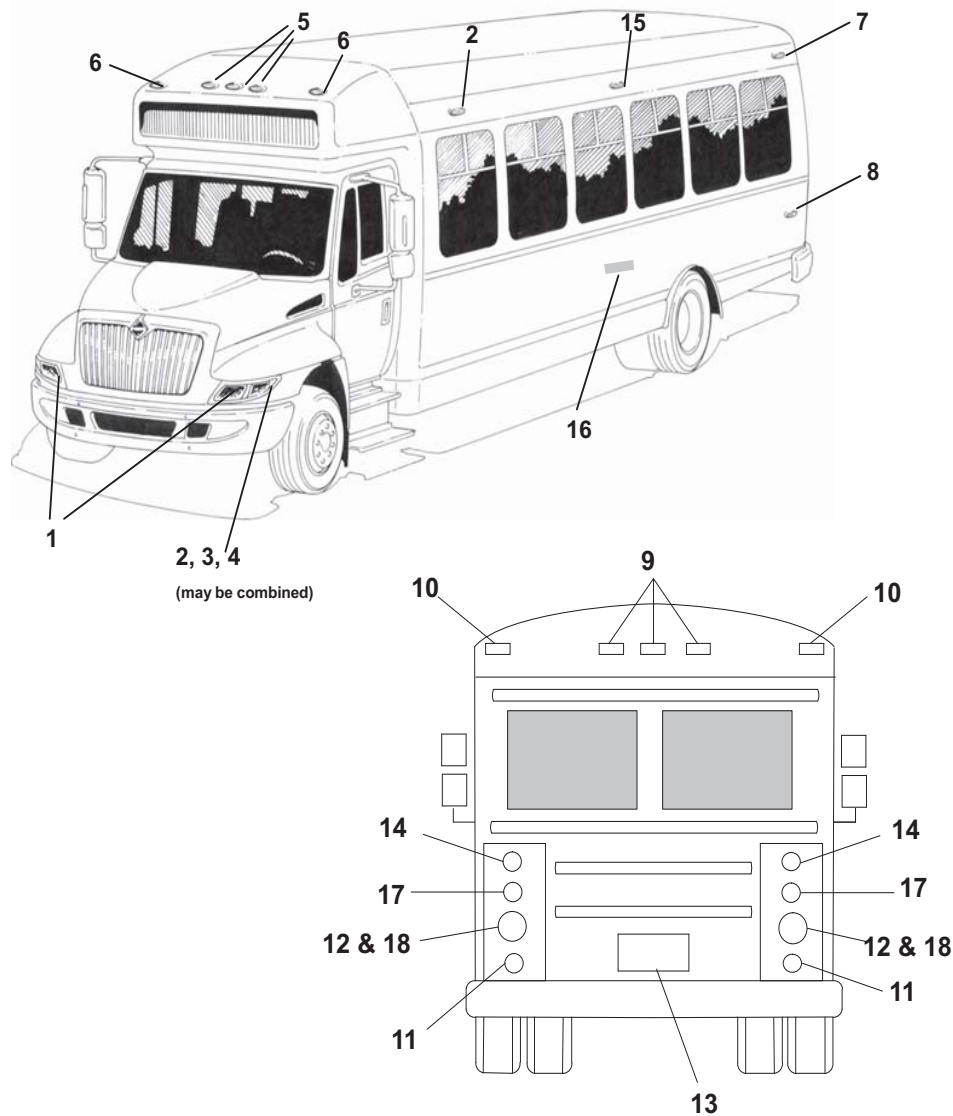
## Required Vehicle Lighting Equipment for Buses with an Overall Width of 80 inches or more

REQUIRED LIGHTING EQUIPMENT	QUANTITY	COLOR	LOCATION	POSITION	HEIGHT ABOVE ROAD SURFACE (In inches measured from the center of the lamp on vehicle at curb height.)
Stop Lamp	2	Red	Rear	One lamp each side of the vertical centerline at the same height and as far apart as practicable.	Both on the same level between 15 and 72.
Front Clearance Lamps	2	Amber	One on each side of front	One on each side of the vertical centerline to indicate width.	Both on the same level as high as practicable.
Rear Clearance Lamps	2	Red	One on each side of rear	One on each side of the vertical centerline to indicate overall width.	Both on the same level as high as practicable.
Side Marker Lamp, Intermediate	2	Amber	One on each side	At or near midpoint between front and rear side marker lamps, if vehicle over 30' in length.	Not less than 15.
Reflex Reflector Intermediate (Side)	2	Amber	One on each side	At or near midpoint between front and rear side reflectors if over 30' in length.	Between 15 and 60.
Reflex Reflector (Rear)	2	Red	Rear	One on each side of vertical centerline, as far apart as practicable.	Both on the same level, between 15 and 60.
Reflex Reflector (Rear Side)	2	Red	One on each side (rear)	As far to the rear as practicable.	Between 15 and 60.
Reflex Reflector (Front Side)	2	Amber	One on each side (front)	As far to the front as practicable.	Between 15 and 60.

Table 1.2

## Required Vehicle Lighting Equipment for Buses with an Overall Width of 80 inches or more

REQUIRED LIGHTING EQUIPMENT	QUANTITY	COLOR	LOCATION	POSITION	HEIGHT ABOVE ROAD SURFACE (In inches measured from the center of the lamp on vehicle at curb height.)
License Plate Lamp Rear	1	White	At rear license plate	To illuminate the license plate from the top or sides.	No requirements.
Side Marker Lamp (Front)	2	Amber	One on each side	As far to the front as practicable.	Not less than 15.
Side Marker Lamp (Rear)	2	Red	One on each side	As far to the rear as practicable.	Not less than 15.
Turn Signal (Rear)	2	Amber or Red	Rear	One lamp on each side of the vertical centerline as far apart as practicable.	Both on the same level, between 15 and 83.
Identification Lamp (Rear)	3	Red	Rear	One as close as practicable to vertical centerline. One on each side.	All three on the same level as close as practicable to the top of the vehicles with lamp centers spaced not less than 6" or more than 12" apart.
Vehicular Hazard Warning Flashing Lamps	2	Amber	Front	One lamp on each side of vertical centerline as far apart as practicable.	Both on the same level, between 15 and 83.
	2	Amber or Red	Rear		
Backup Lamp	1	White	Rear	Rear	No requirement.



## LEGEND

1. Headlamps (2) – White (4 optional)
2. Side marker lamps. Front (2) – Amber
3. Side reflectors. Front (2) – Amber
4. Turn signal lamps. Front (2) – Amber
- 4a. Turn signal lamps. Front (2) – Amber (Optional location)
5. Identification lamps. Front (3) – Amber
- 5a. Identification lamps. Front (3) – Amber (Optional location)
6. Clearance lamps. Front (2) – Amber
7. Side marker lamps. Rear (2) – Red
8. Side reflectors. Rear (2) – Red
9. Identification lamps. Rear (3) – Red
10. Clearance lamps. Rear (2) – Red
11. Reflectors Rear (2) – Red
12. Stop lamps. Rear (2) – Red
13. License plate lamp. Rear (1) – White
14. Backup lamp. Rear (1) – White (location optional provided optional requirements are met)
15. Side marker lamps. Intermediate (2) – Amber (if vehicle is 30' or more overall length)
16. Side reflectors. Intermediate (2) – Amber (if vehicle is 30' or more overall length)
17. Turn signal lamps. Rear (2) – Amber or Red
18. Tail lamps. Rear (2) – Red

Figure 1.1

0\_0005

## ADDITIONAL REQUIREMENTS: EPA

### EPA Part 205 Subpart B, CMVSS 1106 – Noise Emission For Medium And Heavy Trucks

**Incomplete Vehicles** identified as a **Chassis Cab** by Navistar, Inc., and all **Complete Vehicles** will comply with the requirements specified by EPA PART 205 SUBPART B and CMVSS 1106 provided that no changes are made to the noise generating and/or suppression equipment installed by IC Bus<sup>™</sup>.

### EPA Part 86, CMVSS 1100 – Emission Control

Engines provided with IC Bus<sup>™</sup> vehicles will comply with all applicable exhaust emission standards. Modifications to the vehicle and/or engine, which will cause noncompliance, are prohibited by the regulations. For further information see the vehicle owner's manual and the engine manual.

### Replacement or Service Parts

The Motor Vehicle Safety Standards primarily specify the requirements and/or performance standards that a Complete Vehicle must comply with. However, certain specific components of the vehicle, when sold by a dealer or distributor as replacement or service parts, are required to comply with the requirements and/or performance standards specified by the standards. Certification of compliance must also be provided for these components and those items that are subject to these procedures are as follows:

- Windshield and window glass – FMVSS/CMVSS 205
- Seat belts – FMVSS/CMVSS 209
- Hydraulic brake hose – FMVSS/CMVSS 106
- Hydraulic brake fluids – FMVSS/CMVSS 116
- Lamps and reflective devices – FMVSS/CMVSS 108
- Warning devices – FMVSS 125 (Reflective Triangle)
- Tires and Wheels – FMVSS/CMVSS 119/120
- Platform Lift System – FMVSS 403

The standards require that all of the above items manufactured for sale, whether for use in the manufacture of a vehicle or for sale as parts, must comply with applicable provisions of the safety standards. Such items when sold by dealers or distributors must be labeled to certify compliance. Such labeling may be placed on the part itself or on the container in which the part is shipped.

The items listed above that are manufactured by or for Navistar, Inc. as service parts will comply with all applicable standards as required.

## Certification of Incomplete Vehicles Manufactured by IC Bus™

In accordance with the laws of the United States and Canada all vehicles manufactured for sale and sold for use in these countries must comply with the applicable federal safety standards and certification of compliance must be provided with the vehicle.

Section 567.3 of Title 49 of the CFR defines an **Incomplete Vehicle** as an assemblage consisting, at a minimum, of chassis (including the frame) structure, power train, steering system, suspension system, and braking system, in the state that those systems are to be part of the completed vehicle, but requires further manufacturing operations, to become a completed vehicle. For an **Incomplete Vehicle** manufactured by Navistar, Inc. to be classified as a **Complete Vehicle**, subsequent manufactures must mount a body or other load carrying equipment on the chassis prior to delivery to the end user so that it can perform its intended function.

### ***Incomplete Vehicle Manufacturer***

#### **Definition**

Section 567.3 of Title 49 of the CFR defines an Incomplete Vehicle Manufacturer as a person who manufactures an incomplete vehicle by assembling components none of which, taken separately, constitute an incomplete vehicle.

#### **Compliance Responsibility**

As manufactured by Navistar, Inc., an Incomplete Vehicle is built with all appropriate safety items that comply with the applicable regulatory requirements to the extent that the vehicle's state of completion will permit. To obtain a Complete Vehicle status under section 567.3 of Title 49 of the CFR, an Intermediate or Final-Stage Manufacturer must mount a body or other similar load carrying equipment on the chassis prior to delivery to the end user.

Navistar, Inc. identifies an **Incomplete Vehicle** with one of the following designations depending on the vehicle's state of completion:

- Chassis Cab
- Flat Back Cowl (FBC) Chassis Bus or School Bus
- Partial Cab Bus or School Bus
- Partial Cab Truck
- Stripped Chassis

In accordance with section 568.4 of Title 49 of the CFR, Navistar, Inc. furnishes an **Incomplete Vehicle** Document (IVD) with each **Incomplete Vehicle**. This document provides the following information:

- Name and mailing address of the **Incomplete Vehicle** manufacturer
- Date of manufacture
- Vehicle Identification Number
- GAWR (Gross Axle Weight Rating) for each axle of the intended **Complete Vehicle**
- GVWR (Gross Vehicle Weight Rating) of the intended **Complete Vehicle**

- Vehicle Type into which the **Incomplete Vehicle** may appropriately be manufactured
- Suitable tire and rim choice with inflation pressure
- List of all Federal U.S. or Canadian safety standards applicable to the type of vehicle.  
(Those standards to which the vehicle complies as produced by Navistar, Inc. will be identified.)

For all Incomplete Vehicles except those without a cab, the IVD is placed in the left hand door dispatch compartment. For Incomplete Vehicles without a cab, the IVD is placed in a clear plastic envelope and strap locked to the radiator stay rod.

In accordance with section 567.5 of Title 49 of the CFR, IC Bus™ will also affix an Incomplete Vehicle Information Label to the hinge pillar, door latch post, or door edge that meets the door latch post, next to the driver's seating position (reference Figure 1.3).

INCOMPLETE VEHICLE MANUFACTURED BY (VÉHICULE INCOMPLÉT FABRIQUÉ PAR) INTERNATIONAL TRUCK AND ENGINE CORPORATION		Manufactured in the U.S. or Mexico
G/P V/N    XX,XXX KG W/B    XX,XXX LBI R/V FRONT    AXLE    2    3    4    5    6    7 G/P A/N    XX,XXX KG    XX,XXX    XX,XXX    XX,XXX    XX,XXX    XX,XXX    XX,XXX    XX,XXX KG W/B    XX,XXX LBI    XX,XXX    XX,XXX    XX,XXX    XX,XXX    XX,XXX    XX,XXX    XX,XXX LBI R/E VIN    12345678901234567    DATE    MM-YYYY		
O_0008		
INCOMPLETE VEHICLE MANUFACTURED BY (VÉHICULE INCOMPLÉT FABRIQUÉ PAR) INTERNATIONAL TRUCK AND ENGINE CORPORATION CANADA		Manufactured in Canada
G/P V/N    XX,XXX KG W/B    XX,XXX LBI R/V FRONT    AXLE    2    3    4    5    6    7 G/P A/N    XX,XXX KG    XX,XXX    XX,XXX    XX,XXX    XX,XXX    XX,XXX    XX,XXX    XX,XXX KG W/B    XX,XXX LBI    XX,XXX    XX,XXX    XX,XXX    XX,XXX    XX,XXX    XX,XXX    XX,XXX LBI R/E VIN    12345678901234567    DATE    MM-YYYY		
O_0009		

Figure 1.3 Incomplete Vehicle Information Labels

O\_0008, O\_0009

**Canada**

All IC Bus™ Incomplete Vehicles manufactured and sold in Canada must also have a Canada National Safety Mark and National Emissions Mark affixed to the vehicle (reference Figure 1.4).



**Figure 1.4** Canada National Safety Mark and National Emissions Mark

O\_0010

**Intermediate Manufacturer****Definition**

Section 567.3 of Title 49 of the CFR defines an INTERMEDIATE MANUFACTURER as a person, other than the Incomplete Vehicle Manufacturer or Final Stage Manufacturer, who performs manufacturing operations on a vehicle manufactured in two or more stages.

**Compliance Responsibility**

In accordance with section 568.4 of Title 49 of the CFR, Navistar, Inc. furnishes an Incomplete Vehicle Document (IVD) with each incomplete vehicle. Navistar, Inc. will also affix an information label to the hinge pillar, door latch post, or door edge that meets the door latch post, next to the drivers seating position as specified in part 567.5 of Title 49 of the CFR.

In accordance with section 568.5 of Title 49 of the CFR each intermediate manufacturer is required to provide an addendum to the IVD for any modification made by them to the incomplete vehicle that affects the validity of the compliance statements that appear in the IVD. The addendum must provide the name and mailing address of the intermediate manufacturer and specify the changes that must be made to the IVD to reflect the modifications that they made to the vehicle.

## ***Final Stage Manufacturer***

### **Definition**

As defined by section 567.3 of Title 49 of the CFR, a FINAL – STAGE MANUFACTURER is a person who performs such manufacturing operations on an incomplete vehicle that it becomes a complete vehicle.

### **Compliance Responsibility**

Section 568.6 of Title 49 of the CFR requires that the final – stage manufacturer shall complete the vehicle in such manner that it meets all applicable safety standards in effect on the date of manufacture of the incomplete vehicle, the date of final completion, or a date between these dates. When completed, the tractor must comply with all applicable Federal Motor Vehicle Safety Standards. Section 567.5 of Title 49 of the CFR stipulates that the Final Stage Manufacturer is responsible for installing an appropriate certification label that must be securely and permanently affixed to the completed vehicle.

For those situations when an entity other than an International facility certifies a completed vehicle, that entity becomes the Final – Stage Manufacturer and has the option to create its own label or purchase a label from IC Bus™ service parts. Labels purchased from service parts do not have the name of the Final - Stage Manufacturer and information about the vehicle. This information has been left blank. Final – Stage Manufacturers that utilize the appropriate label and protective cover (435654C2) and provide the required information comply with the requirements specified by part 567 of Title 49 of the CFR. The label (see Figure 1.4) is referred to as a “Final Stage Manufacturer Certification Label” and is identified with International part number 436076C4 for a vehicle sold in the U.S. or 1698980C2 for a vehicle sold in Canada.

436076C4

MFD. BY \_\_\_\_\_ DATE \_\_\_\_\_  
 INC. VEH. MFD. BY \_\_\_\_\_ DATE \_\_\_\_\_

FRONT FR-REAR-RR

GVWR	KG	GVWR	KG	GVWR
LB	LB	LB	LB	LB

A SUITABLE TIRE AND RIM CHOICE AT PSI COLD SINGLE AT PSI COLD DUAL

TIRES RIMS TIRES RIMS

THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL MOTOR VEHICLE SAFETY STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE

VIN \_\_\_\_\_ TYPE \_\_\_\_\_

GVWR AND GAWR ARE BASED ON ORIGINAL EQUIP. A CHANGE MAY AFFECT VEHICLE CAPACITIES. SEE OWNER'S MANUAL FOR OTHER TIRE AND CAPACITY INFORMATION.

O\_0011

436076C4 – U.S>

1698980C2

Mfd. By \_\_\_\_\_ DATE \_\_\_\_\_  
 INC. VEH. MFD. BY \_\_\_\_\_ DATE \_\_\_\_\_

FRONT FR-REAR-RR

G / P	KG	G / P	KG	G / P
R / N	LB	R / N	LB	R / N
V / V		V / V		V / V

A SUITABLE TIRE AND RIM CHOICE AT PSI COLD SINGLE AT PSI COLD DUAL

TIRES RIMS TIRES RIMS

VIN \_\_\_\_\_ TYPE \_\_\_\_\_

1698980C2

O\_0012

1698980C2 – Canada>

**Figure 1.5** Final Stage Manufacturer Certification Label

## Canada

Certified Final – Stage Manufacturers of Canadian vehicles must affix the Canada National Safety Mark and National Emissions Mark with their identification number installed on it next to the final certification label shown above. Such authorization and identification number must be obtained from the Minister of Transport at Transport Canada. [Reference: Figure 1.4 – "Canada National Safety Mark and National Emissions Mark".]

## Alterations To Completed Vehicles

### Definition

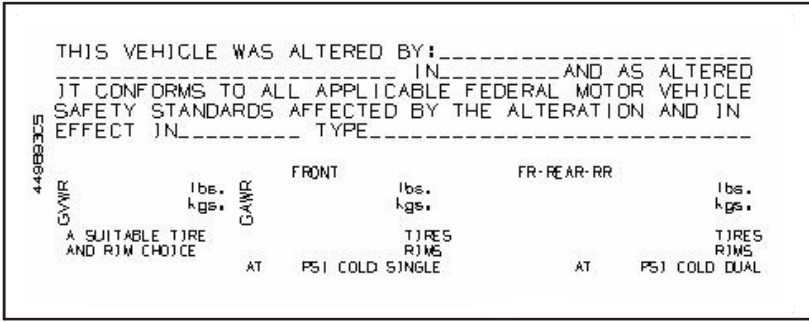
Section 567.3 of Title 49 of the CFR defines an Altered Vehicle as a completed vehicle previously certified in accordance with section 567.4 or 567.5 that has been altered other than by the addition, substitution, or removal of readily attachable components or by minor finishing operations, before the first purchase of the vehicle other than for resale, in such a manner as may affect the conformity of the vehicle with one or more FMVSS or the validity of the vehicle's stated weight ratings or vehicle type classification.

### Compliance Responsibility

In accordance with section 567.7 of Title 49 of the CFR, if a person alters a certified vehicle before the first purchase of the vehicle other than for resale, the responsibility for compliance of the modified vehicle rests with the Alterer. The vehicle manufacturer's Certification Label and any Information Labels shall remain affixed to the vehicle and the alterer shall affix an additional certification label that will supplement the certification label originally furnished with the vehicle by Navistar, Inc. or the Final – Stage Manufacturer. This certification label must state the following:

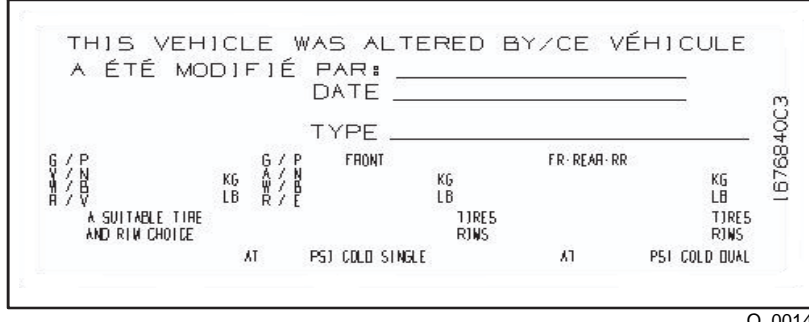
“This vehicle was altered by (name of Alterer) in (month and year in which alterations were completed) and as altered it conforms to all applicable Federal Motor Vehicle Safety Bumper and Theft Prevention Standards affected by the alteration and in effect on the date of (no earlier than the date of manufacture of the certified vehicle as specified on the certification label and no later than the date alterations were completed).”

This label (Reference Figure 1.6) is available from International service parts under Part No. 449893C5 for U.S. Certified Vehicles and Part No.1676840C3 for Canada Certified Vehicles. Protective cover 435654C2 should be installed over this label.



O\_0013

449893C5  
for U.S. Certified Vehicles



O\_0014

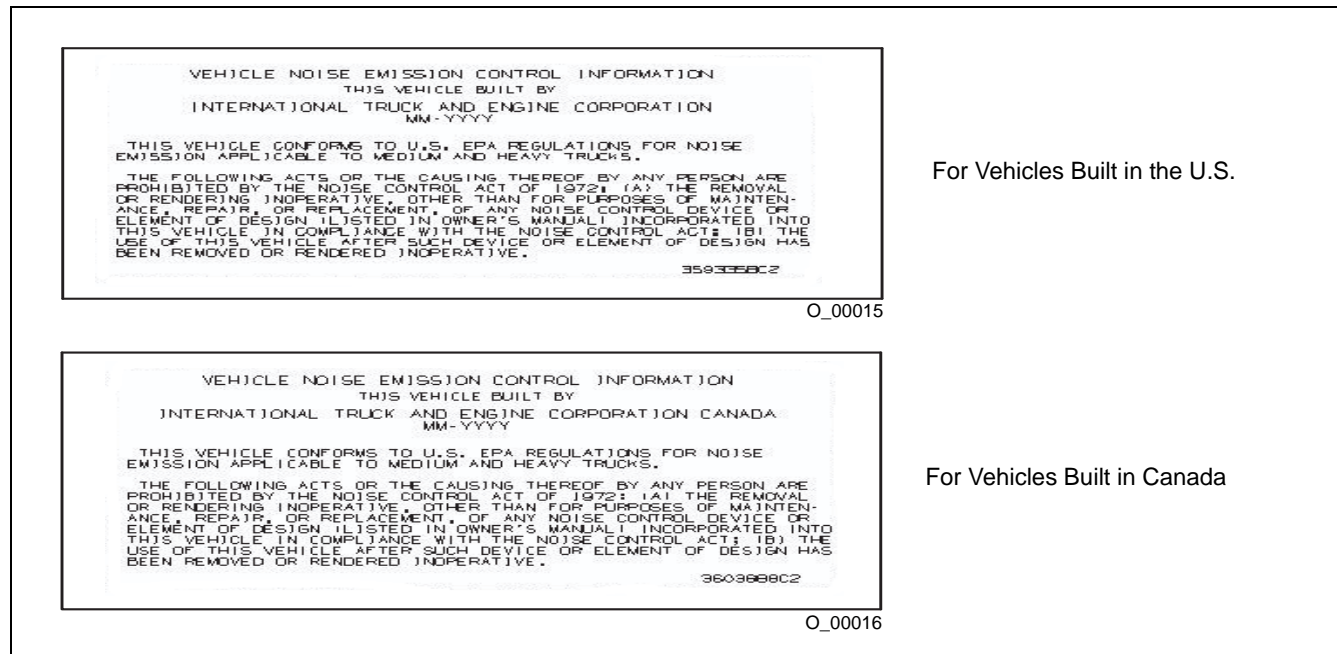
1676840C3  
for Canada Certified Vehicles

**Figure 1.6** Vehicle Alterer Certification Label

Alterers of Canadian certified vehicles must apply the Canada National Safety Mark and National Emissions Mark, with their identification number, adjacent to the Vehicle Alterer Certification label. Such authorization and identification number must be obtained from the Minister of Transport at Transport Canada. [Reference Figure 1.4 – "Canada National Safety Mark and National Emissions Mark".

## Exterior Noise Certification Label

Incomplete vehicles identified as a chassis cab by Navistar, Inc. have the vehicle exterior noise label (Reference Figure 1.7) permanently attached in a readily visible position in the operators compartment. For incomplete vehicles other than a chassis cab, the final stage manufacturer must assume responsibility and comply with EPA PART 205 SUBPART B, CMVSS 1106 – NOISE EMISSION FOR MEDIUM AND HEAVY TRUCKS.



**Figure 1.7** Vehicle Exterior Noise Label

## Additional Certification Label Information and Instructions

1. All labels must be fully filled out.
2. All labels must be affixed to the vehicle in accordance with Sections 567 of Title 49 of the CFR or Canadian Motor Vehicle Safety Regulations, Sections 6 and 7.
3. No label shall be installed over another label.
4. It is unlawful to affix an incorrect certification label to a vehicle.

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## 4X2 SPECIFICATIONS/CHASSIS DIAGRAMS

### Weight Distribution/Dimensions/Turning Radius Chart

Wheelbase (in.)	Cab	Chassis Weight (lbs.) **			Dimensions (in.)				Turning Radius	
		Front	Rear	Total	CA	CF	AF	OAL	To Curb	w/Bumper Clearance
158*	16035	4,659	3,308	7,967	83.6	183.6	100.0	290.6	25 ft. 10 in.	26 ft. 9 in.
169	16035				94.6	194.6	100.0	301.6	27 ft. 5 in.	28 ft. 4 in.
195	16035				120.6	218.6	98.0	325.6	31 ft. 2 in.	32 ft. 1 in.

Chart data based on vehicle with standard equipment. Artwork may show some optional equipment.

\* Dimension data and optional add-on weights for this model are based on the 158" wheelbase with 100" after frame unless otherwise noted.

\*\* Weight includes standard chassis, standard tires, oil and water, but less fuel.

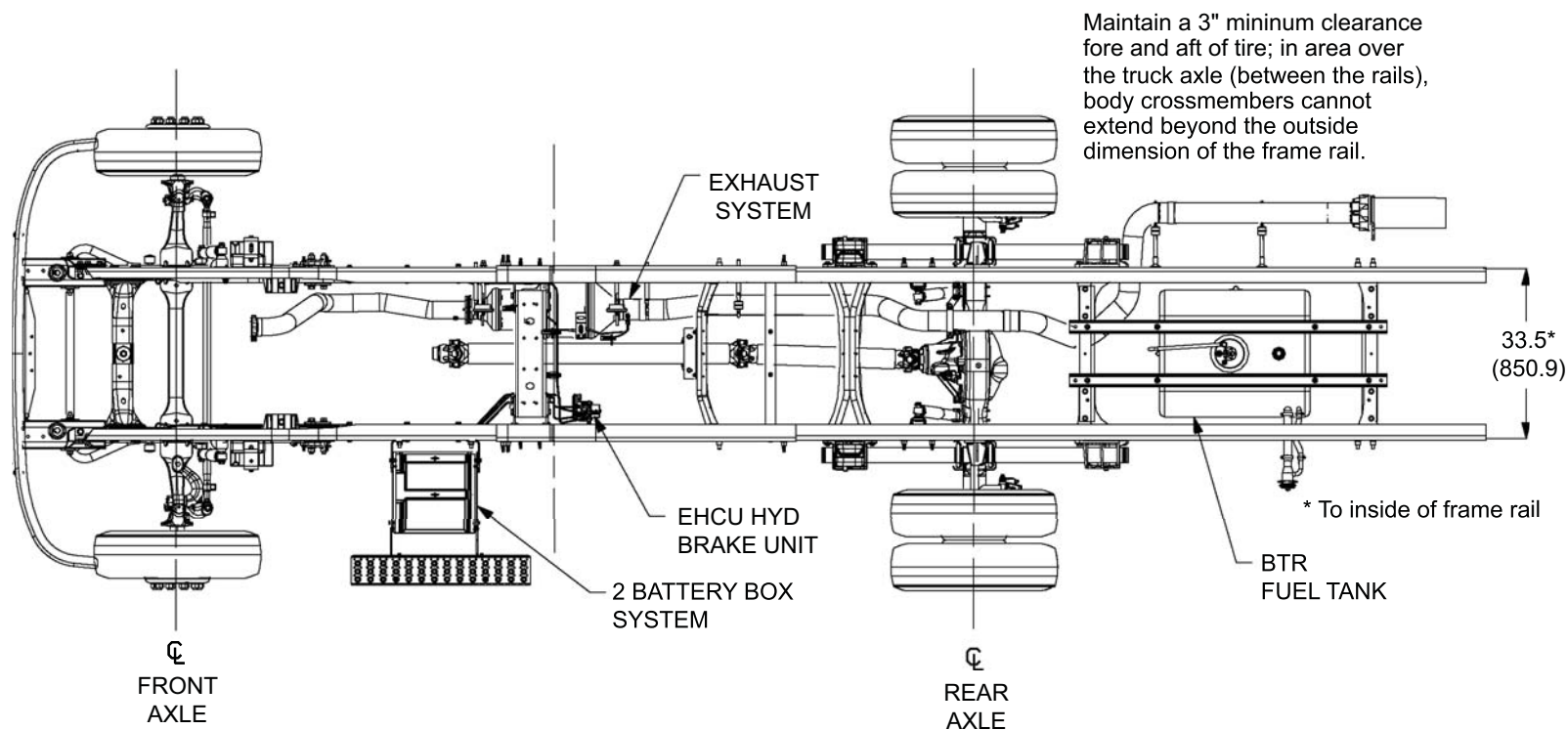
**MODEL 4x2****Standard Features**

All ground dimensions on this chassis diagram are based on a bus with the following equipment and a loaded chassis

Item	Specification
Frame	FRAME RAILS High Strength Low Alloy Steel (80,000 PSI Yield); 7.375" x 3.079" x .312" (187.45mm x 78.2mm x 8.0mm) With Transition to 9.125" x 3.079" x .312" (231.8mm x 78.2mm x 8.0mm); Includes 1.2" (30mm) Drop Under Cab; 335.2" (8512.2mm) Maximum OAL (Code 01CDN)
Front Axle	AXLE, FRONT NON-DRIVING (Dana Spicer D600-N) I-Beam Type, 6,000-lb Capacity (Code 02AGN)
Front Suspension	SUSPENSION, FRONT, SPRING Taper Leaf, Shackle Type; 6,000-lb Capacity; With Shock Absorbers (Code 03AGP)
Rear Axle	AXLE, REAR, SINGLE (Dana Spicer S110) Single B10 Reduction, With Offset Housing; 13,500-lb Capacity, 160 Wheel Ends (Code 14ACN)
Rear Suspension	SUSPENSION, RR, SPRING, SINGLE Vari-Rate; 13,500-lb Capacity (Code 14SAC)
Tires – Front & Rear	Goodyear, 225/70R, 19.5/LR-F (Code 7709440101)

## MODEL 4x2

### Chassis Diagram – Plan View – Standard Cab

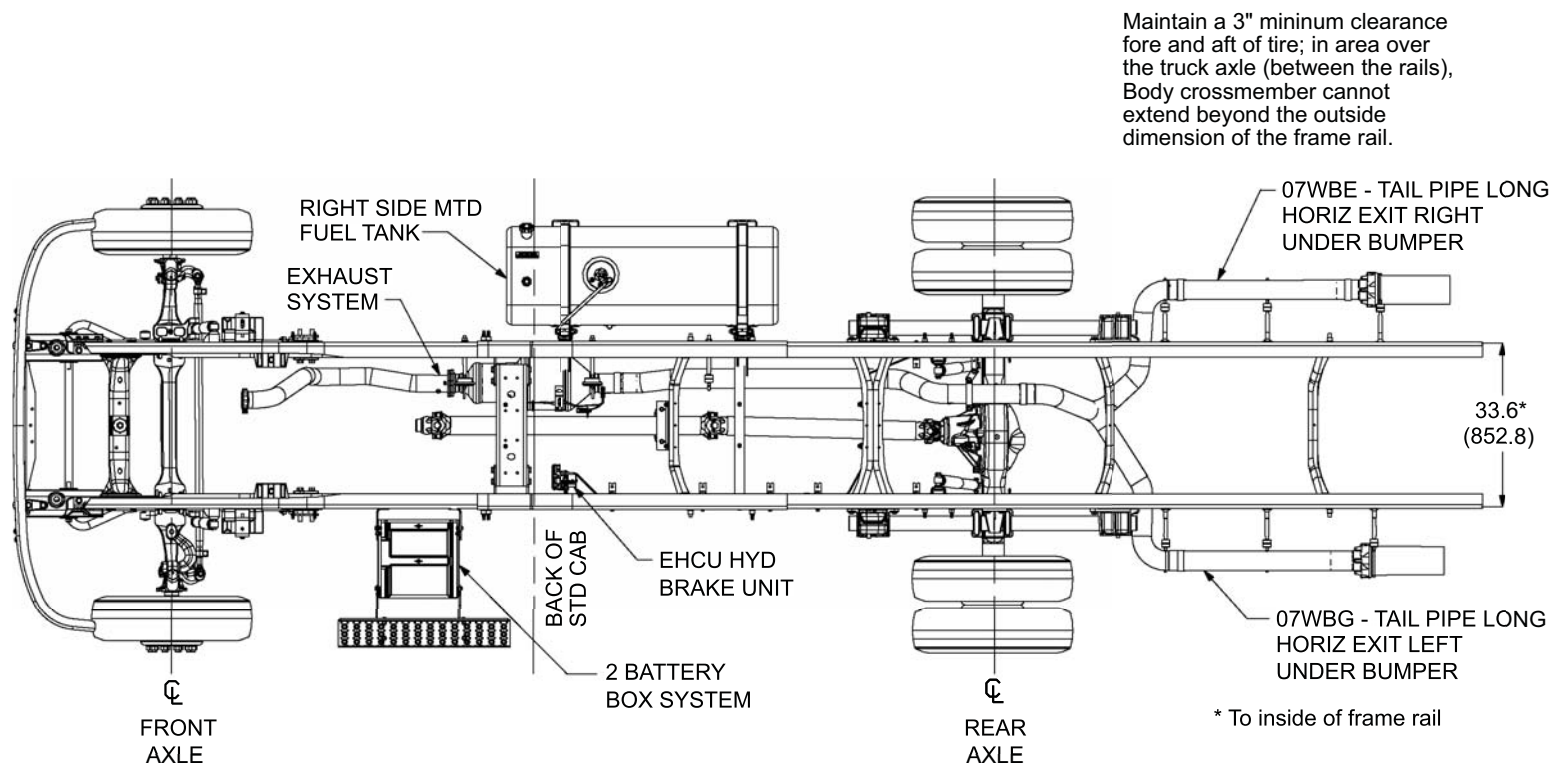


UC\_std\_cab\_plan\_view

**NOTE:** This drawing **should not** be used to determine crossmember locations — that information can be found beginning on page 62 in this book.

## MODEL 4x2

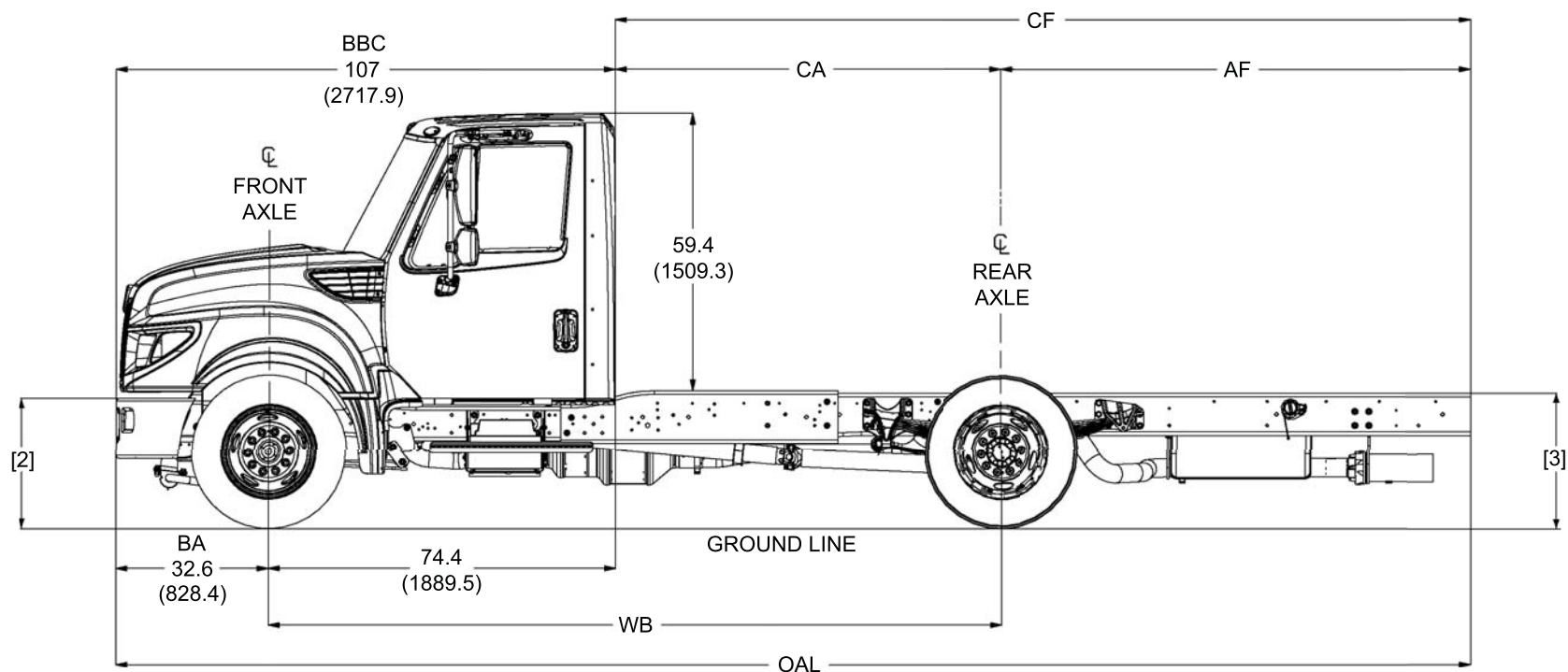
### Chassis Diagram – Plan View – Standard Cab with Optional Right Side Mounted 55 Gallon Fuel Tank



**NOTE:** This drawing **should not** be used to determine crossmember locations — that information can be found beginning on page 62 in this book..

## MODEL 4x2

### Chassis Diagram – Side View – Standard Cab



UC\_side\_view

Frame height values represent standard equipment and are intended for reference only. To compute actual frame height, refer to the frame height calculation section beginning on page 69

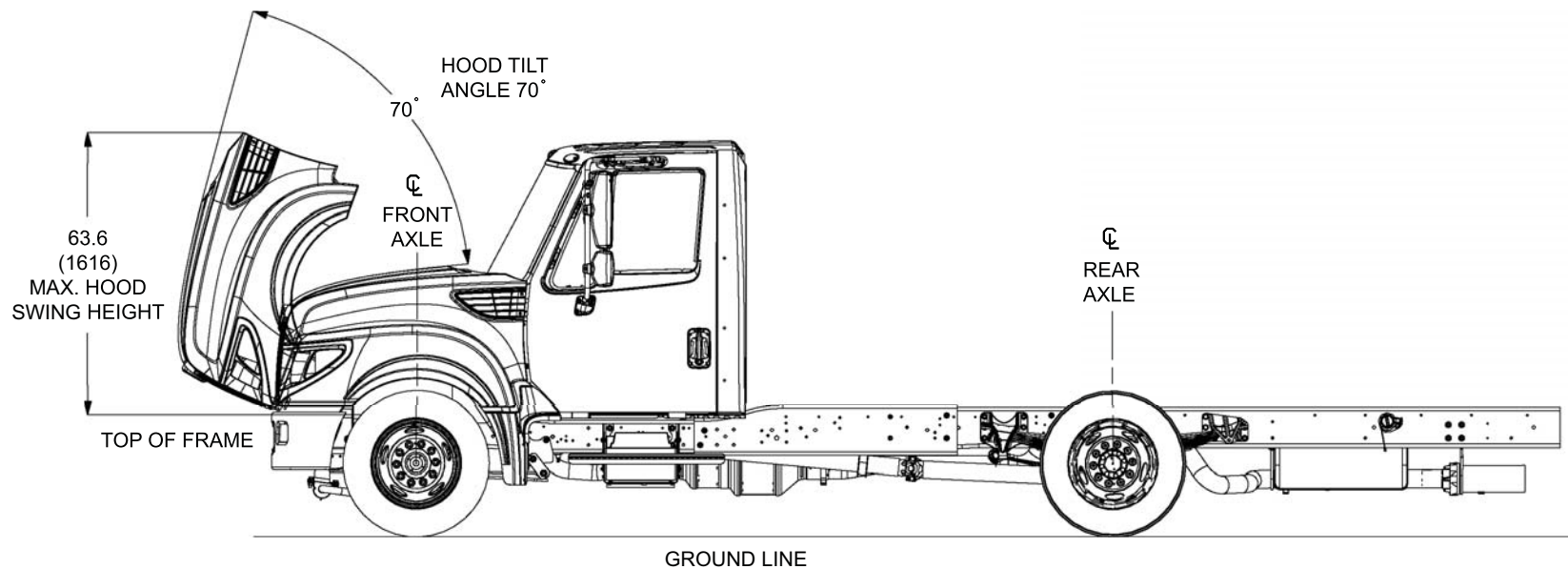
[2] Frame Height at centerline of front axle: unloaded – 26.23", loaded – 25.79"

[3] Frame Height at centerline of rear axle: unloaded – 32.14", loaded – 29.30"

**NOTE:** Due to internal spring friction and manufacturing tolerances, these values may vary up to 0.5 inches. To achieve these nominal values directly after loading or unloading a vehicle, it may be necessary to drive the vehicle for a short period.

## MODEL 4x2

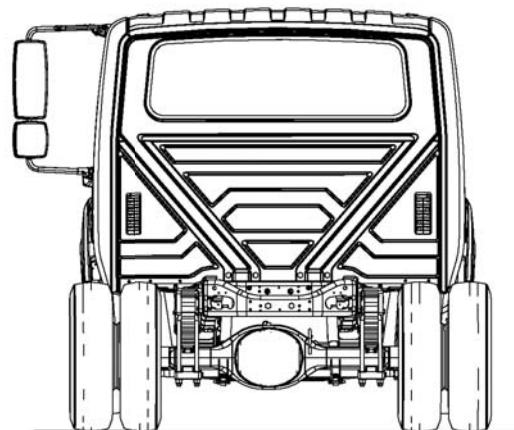
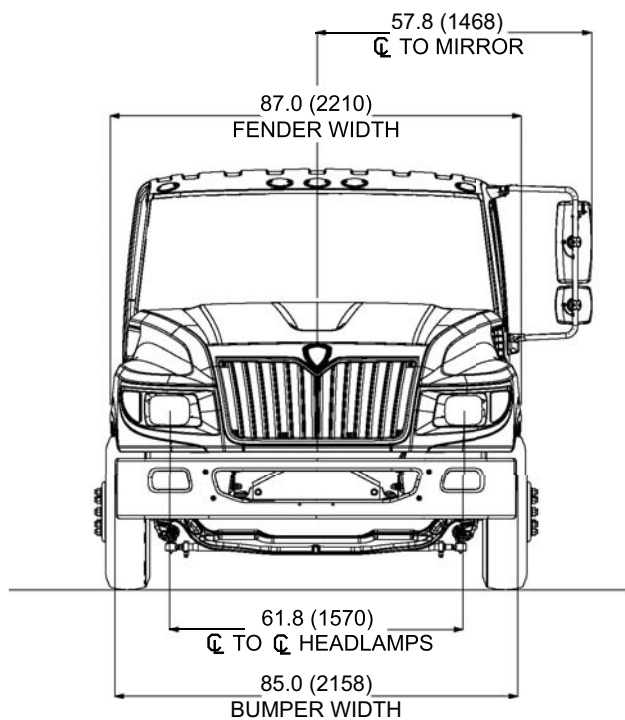
### Chassis Diagram – Side View – Hood Tilt Dimensions



UC\_side\_hood\_tilt

## MODEL 4x2

### Chassis Diagram – Front and Rear View



UC\_front\_rear\_view



A **NAVISTAR** COMPANY

## FRAMES

### *ALL MODELS*

#### General Frame Information

##### Introduction

The frame is the structure that carries and supports the rated load under anticipated driving conditions and secures the major components of a vehicle in their relative positions. The frame assembly consists of two sidemembers and depending upon the length of the frame, five or more crossmembers.

##### General Frame Recommendations

It is very important that the frame be inspected periodically for cracks, buckling, crossmember loosening or other damage that may cause eventual failure of the frame. Additional inspections should be made whenever the chassis has been overloaded or involved in an accident. An alignment check IS NOT SUFFICIENT since local cracks, crossmember loosening or sidemember buckling will not necessarily cause misalignment.

On reinforced sidemember sections, when cracks exist in either of the sidemember sections, the members must be separated for repair. After separation follow the procedures for non-reinforced sections. The two sidemember sections MUST NOT be welded together. After the weld repairs, the sections should be reinforced with the appropriate section and re-assembled with mounting bolts tightened to SAE Grade 8 torque levels.

##### ***Drilling or Notching***

Sidemembers should not be drilled or notched without approval from IC Bus™ Engineering. Do not exceed the maximum allowable sidemember hole size in the unrestricted zones. See model specific books for illustrations.

##### ***Welding or Flame Cutting***

Welding or flame cutting of the frame components is unacceptable because of the associated loss of fatigue strength. This restriction applies not only to the heat-treated components, but also the high strength low alloy (HSLA) and low carbon steel components.

Exceptions to this are cases with IC Bus™ Engineering approval or for repair operations as described in this service manual section.

To avoid serious personal injury, death or possible engine damage, when welding or using an acetylene torch always wear welding goggles and gloves. Insure that acetylene and oxygen tanks are separated by a metal shield and are chained to a cart. Do not weld or heat areas near fuel tanks or fuel lines. Utilize proper shielding around hydraulic lines.

### ***Reinforcement to Increase Capacity***

Reinforcement of the chassis frame to support either additional loading or concentrated loading does not increase vehicle load carrying capacity unless it has been fully verified that all other vehicle components, such as the brake system, steering system, suspension system, etc. can properly and safely support the increased loading.

### ***Increase in Local Stress***

In any modification of the chassis frame, the addition of holes, reinforcements, welds, clamps, splices, etc., may cause an increase in the local stress in the frame at the point of the modification, **therefore causing a stress concentration in the frame sidemember(s).**

These local stress concentrations can significantly affect the life of the chassis frame. The specific effect which the stress concentrator will have on the life of the chassis frame is influenced by the location of the stress concentration, the frequency and severity of the loading, and the magnitude of stress concentration.

Deviation from the repair procedures in this section may void manufacturer's warranty.

### **Identification of Frame Rail Material**

IC Bus™ chassis are manufactured with frame rails of different alloy steels and some are heat-treated. Each material must be handled in a specific manner to assure maximum service life; therefore, the frame material must be determined before attempting repair or modification.

IC Bus™ chassis are presently manufactured with frame rails of:

- High strength low alloy (HSLA) steel (50,000, 60,000 and 80,000 PSI yield strength)
- Heat treated steel (110,000 and 120,000 psi yield strength).

Each type has different repair procedures. The frame rail material can be determined by inspecting the frame and consulting the dealer vehicle lineset ticket and the sales data book.

Heat-treated rails are marked on the inside of the section with a decal which cautions against welding, flame cutting or the addition of holes in critical zones. These practices are restricted for all frame rails, however, **heat-treated** rails are much more sensitive to these alterations.

## Frame Damage

The major sources of frame damage are accidents, overloading the vehicle, and local overstressing due to a variety of causes. In accident cases, the reasons for the damage are readily apparent. Such damage may often be repaired by:

- Straightening and reinforcing the frame.
- Repairing the damaged area and reinforcing the frame sidemember.
- Replacing the frame sidemembers and crossmembers.

Damage to the chassis frame, such as a crack in the frame sidemember or crossmember, which is not associated with impact damage, may be an indication of overloading the vehicle. Damage to the chassis frame may also be an indication of the creation of locally high stresses due to operating conditions or equipment mounting practices. Examples of overloading are:

1. Exceeding either the gross vehicle weight rating (GVWR) or the gross axle weight rating (GAWR) (loading the frame beyond its design capacity).
2. Uneven load distribution.
3. Using the vehicle in operating conditions or with equipment it was not designed for.

Examples of creation of locally high stresses are:

1. Mounting bodies or equipment in a manner that causes stress concentrations and/or abrasive wear in either the flange or web portion of the sidemember.
2. Improper modification or repair of frame components.
3. Equipment which is susceptible to resonant vibration due to excess flexibility of its mounting.

Frame damage may also be caused by corrosion resulting from the contact between dissimilar metals.

Damage to the chassis frame, which is not associated with impact damage, should not be repaired until the cause of the damage has been determined and corrective actions taken to prevent re-occurrence of the non-impact damage.

## Welding and Reinforcement

The guidelines below deal with the general procedures for weld repair and reinforcement. Because of the many variables associated with these repairs, it is recommended that your field service representative be consulted prior to undertaking the repair. This will also help to determine whether a specific set of recommendations has already been developed for the case in question.

The essential elements of repairing the sidemembers are the restoring of BOTH the shape and local strength so that the load capacity is at least as good as before the damage occurred. The sidemembers may *look* like new, but may have local strength reduction due to small cracks or material strength reduction. Even if the frame has acceptable alignment and there is no gross deformation, local deformations may reduce the strength in the area to be weld repaired. Examples of this are local bulges in the web (vertical portion) of the section and buckling of the flanges. These local deformations must be repaired by straightening before proceeding with the weld repair.

### **Welding Precautions**

When welding on any vehicle, care must be taken to prevent damage to the electronic components. Vehicles with ELECTRONIC ENGINE CONTROL SYSTEMS require additional precautions.

**CAUTION:** On any vehicle, disconnect both the positive and negative battery cables from the battery before welding on the vehicle. Attach the welder ground cable as close as possible to the part being welded.

To avoid serious personal injury, death or possible engine damage, when welding or using an acetylene torch always wear welding goggles and gloves. Insure that acetylene and oxygen tanks are separated by a metal shield and are chained to a cart. Do not weld or heat areas near fuel tanks or fuel lines. Utilize proper shielding around hydraulic lines.

With an electronic engine controller (such as Celect), do not connect the ground cable to the control module(s) or the cooling plate. To protect the control module(s), it is mandatory to remove all connectors going to the control modules.

The following is a general guideline for the steel frames:

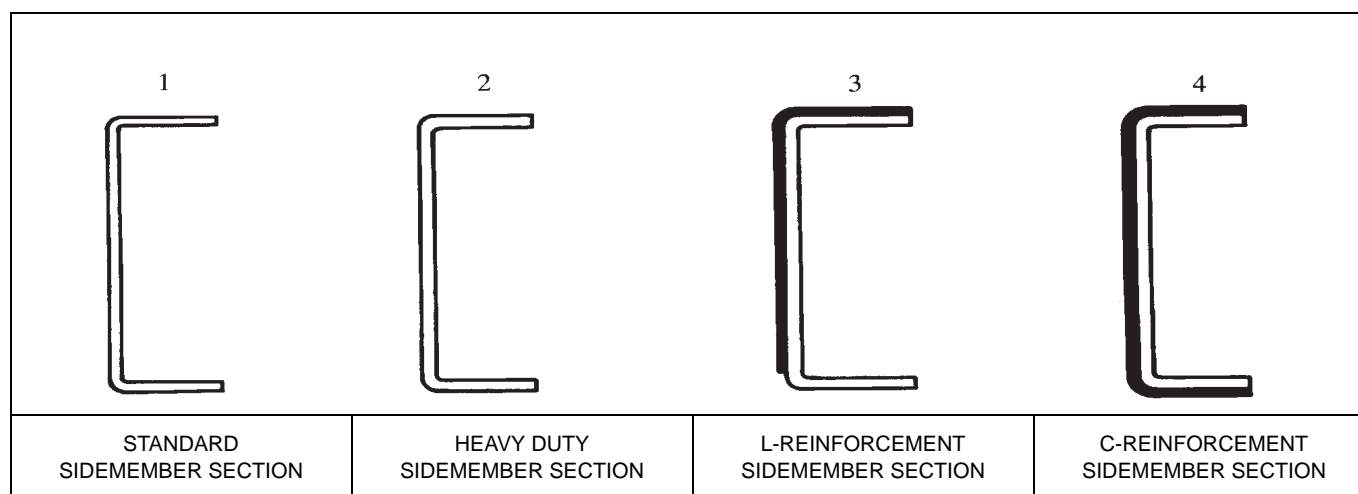
Welding of the HSLA (50,000, 60,000 and 80,000 PSI yield strength) steel side member and the heat-treated (110,000 and 120,000 PSI yield strength) steel sidemember involves a significant reduction in the strength of the frame in the heat affected zones of the weldment. This means that the frame in the welded region is no longer capable of carrying the same load or stress as the original section.

To restore the strength of the frame rails after welding, the welded area must be reinforced using reinforcements as indicated in “Repair and Reinforcement Recommended Procedures”.

Welding must be done properly to make an effective repair. Therefore, only those who are properly trained and qualified should perform the welding repairs in this section.

### Reinforcement

Reinforcements (Figure 2.1) to increase load capacity are generally “full length”. The actual length of the reinforcement varies with the model. Shorter, (approximately 7') rear suspension tandem liner reinforcements are available for some tractor models. Inverted “L” and “C” channel reinforcements are available for most models. For models which do not have reinforcements necessary to contact Sales Engineering to obtain reinforcement recommendations.



**Figure 2.1** Frame Rails and Reinforcements (Typical)

01\_0011

These reinforcements are generally installed on the outside of the sidemember, although certain models require “C” channel reinforcements installed to the inside of the sidemember. Contact your IC Bus™ dealer regarding the required type of reinforcement.

Depending on model application, there will be other parts affected, such as spring brackets for example, which are bolted to the flange as well as the web of the sidemember. To maintain proper alignment of the springs, these brackets may require replacement with new brackets designed to accept the reinforcements. These brackets are available through your IC Bus™ parts department.

**NOTE:**When an inside reinforcement is added, the lengths of the crossmembers will be affected.

***Reinforcement Attachment***

**The reinforcements must never be welded to the original chassis sidemembers.** High strength SAE Grade 8 bolts are to be used to fasten the reinforcement to the sidemember. Existing bolt holes in the sidemembers should be used whenever possible.

**NOTE:** The reinforcements should be bolted to the chassis frame using high strength SAE Grade 8 bolts not less than 0.5 inch (13 mm) in diameter (refer to “Bolt and Torque Information”).

**Corrosion**

If aluminum and steel are allowed to come into direct contact with each other, a galvanic cell can be formed. In order for the cell to form, the dissimilar metals must be in direct contact and an electrolyte, such as moisture, must be present. Aluminum is anodic with respect to steel and will corrode when in the presence of steel. Corrosion of aluminum frame crossmembers will reduce the load carrying capacity of the frame member and may eventually lead to the failure of the frame.

To prevent the formation of a galvanic cell, isolation techniques such as non-conductive or barrier type spacers or sealers must be used so that the steel and aluminum are not in direct contact.

It is recommended that a sealer, such as Tectyl 400C or equivalent, be painted onto the surface of both the aluminum and steel, as well as on the washers under the head of the bolts and nuts.

**Frame Alignment**

The frame must be properly aligned as this affects body, axle and suspension mounting. If the vehicle has been involved in an accident or has been overloaded, it is recommended that the frame be checked for proper alignment.

***Pre-Alignment Inspection***

Before checking alignment, park vehicle on level ground and set parking brake. Inspect frame assembly for loose parts, welds, cracks and bends. Be sure to make all necessary repairs before attempting to check frame alignment.

***Method of Checking Frame Alignment***

A satisfactory method of checking the frame and axle alignment, particularly when a body and cab is on a chassis, is to:

1. Place a plumb bob against the point of measurement. All measurements must be taken with the plumb bob positioned against bare metal.
2. Tack or tape pieces of paper to the floor directly under each point of measurement on the chassis as indicated by the letter “K” in Figure 2.2.

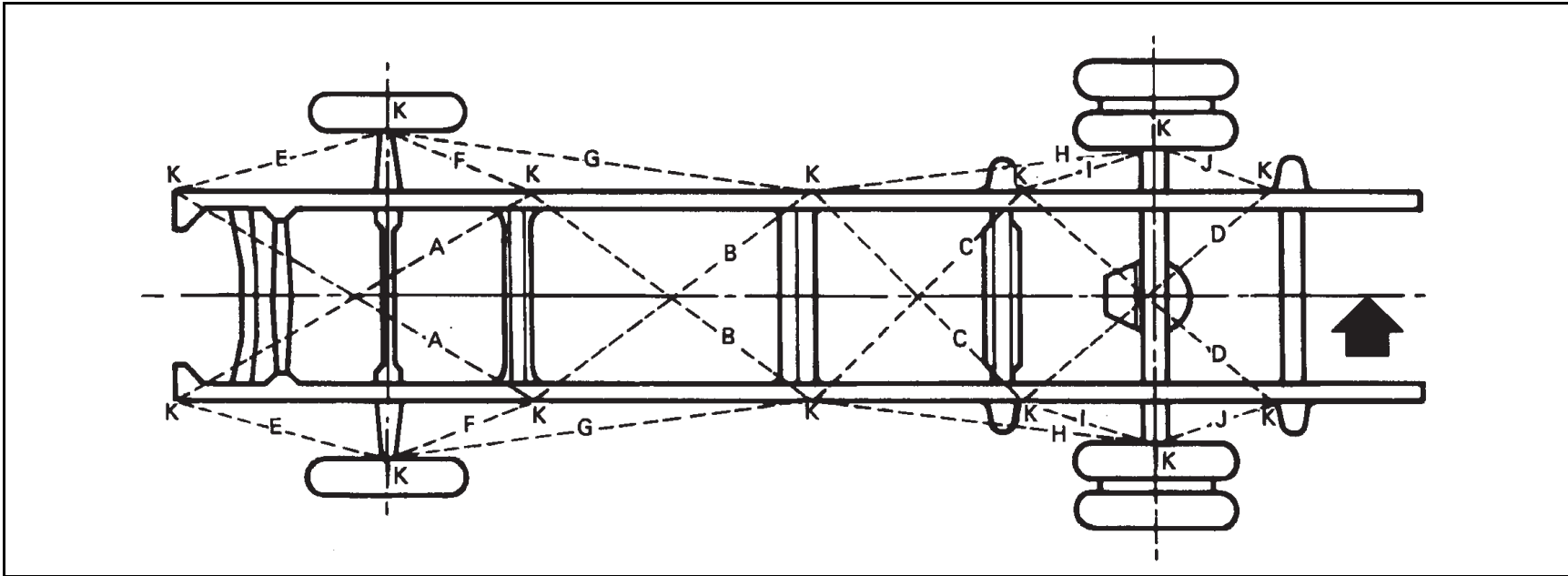


Figure 2.2 Centerline of Chassis

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### Method of Checking

After each measurement point has been carefully marked on the floor, proceed as follows:

1. Locate centerline of chassis by measuring front and rear end widths, using marks on floor.

If frame widths are within specification, draw centerline on floor, the full length of the chassis and continue with step 2.

If frame widths are out of specification, lay out centerline as follows:

Centerline can be drawn through the intersection of any one pair of equal diagonals (A-A, B-B, C-C, D-D) and center point of one end of frame or through points of intersection of any two pairs of equal diagonals.

2. Measure distance from centerline to opposite points marked over entire length of frame. Measurements should not vary more than 0.12 inch (3.0 mm) at any point.
3. Measuring diagonals (A-A, B-B, C-C, D-D) will indicate point where misalignment occurs. If diagonals in each pair are within 0.12 inch (3.0 mm), that part of the frame included between points of measurement may be considered in satisfactory alignment. These diagonals should intersect within 0.12 inch (3.0 mm) of the centerline.

If the diagonals are not within specification, try loosening and re-tightening all cross-members. Then re-check alignment. Refer to the “Bolt Torque Chart (Phosphate and Oil Coated)”. If frame is still out of alignment, the vehicle must be taken to a suitable frame alignment establishment to confirm frame misalignment. If misalignment is confirmed, suitable measures must be taken to repair the damage.

### **Side Elevation Dimensions**

Dimensions for side elevation of the frame should be checked at the points indicated and should not vary more than 0.12 inch (3.0 mm) from side to side. (They will differ fore and aft due to typical frame rake.)

### **Axle Alignment With Frame**

After determining that the frame is properly aligned, the axle alignment with the frame should be checked by comparing diagonals.

If necessary, adjust axle-to-frame alignment.

### **Frame Straightening**

**NOTE:** Frame straightening should only be performed by a qualified frame alignment facility. Under no circumstance should frame alignment be performed by inexperienced or unqualified service personnel.

### **Do not use heat to straighten.**

Use of heat is not recommended when straightening heat-treated frame sidemembers. Heat will weaken these frame members, consequently, all straightening should be done at room temperature. Add reinforcement per section if heat straightening is done.

Frame members which are bent or buckled sufficiently to show cracks or weakness after straightening should be replaced or reinforced. **Heat-treated frame members must not be intermixed with non-heat-treated members.**

If one sidemember is to be replaced, the new member must match the former frame member in both cross-section and material strength.

## **Repair and Reinforcement Recommended Procedures**

In some cases of frame damage, the sidemembers must be replaced rather than repaired. Examples of this are:

1. When sidemember cracks caused complete separation or a visible deformation of the section.
2. When the sidemembers are extensively deformed. Consult with your field service representative and frame repair specialists if in doubt.

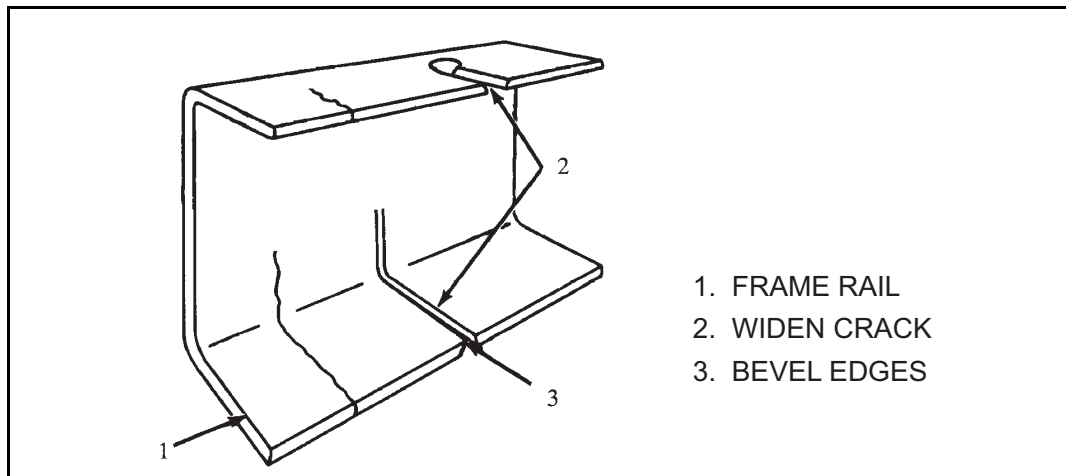
## **Preparation of Frame for Repair**

### **Bevel Crack to Weld**

To assure complete weld penetration, bevel the crack from one side when welding from one side. Bevel the crack from both sides when welding from both sides. The existing crack in the sidemember must be entirely removed (Figure 2.3). Widen the crack its full length to 1/8 inch (3 mm). If required, a rubber backed disc grinder or high speed steel burr may be used.

### **Clean Surface to Weld**

Surfaces to be welded and surfaces adjacent to the weld must be free of loose scale, slag, rust, grease, moisture, paint or other material that could contribute to poor quality welds.



**Figure 2.3** Preparing For Weld Repair

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### **Welding**

Electric arc-welding is recommended for repair of steel frames. The shielded arc method should be used because the heat generated during welding is localized and burning of material is minimized using this method. Additional advantages are that the finished weld can be ground flush and drilled as necessary.

Shielded metal arc welding (SMAW); gas metal arc welding (GMAW), also known as metal inert gas (MIG) welding; gas tungsten arc welding (GTAW), also known as tungsten inert gas (TIG) welding; or flux cored arc welding (FCAW) are recommended methods for repair of steel frame members.

To avoid serious personal injury, death or possible engine damage, when welding or using an acetylene torch always wear welding goggles and gloves. Insure that acetylene and oxygen tanks are separated by a metal shield and are chained to a cart. Do not weld or heat areas near fuel tanks or fuel lines. Utilize proper shielding around hydraulic lines.

### **General Recommendations**

**IMPORTANT:** To properly perform the repair procedure, the following rules must be observed:

#### **All Steel Sidemembers**

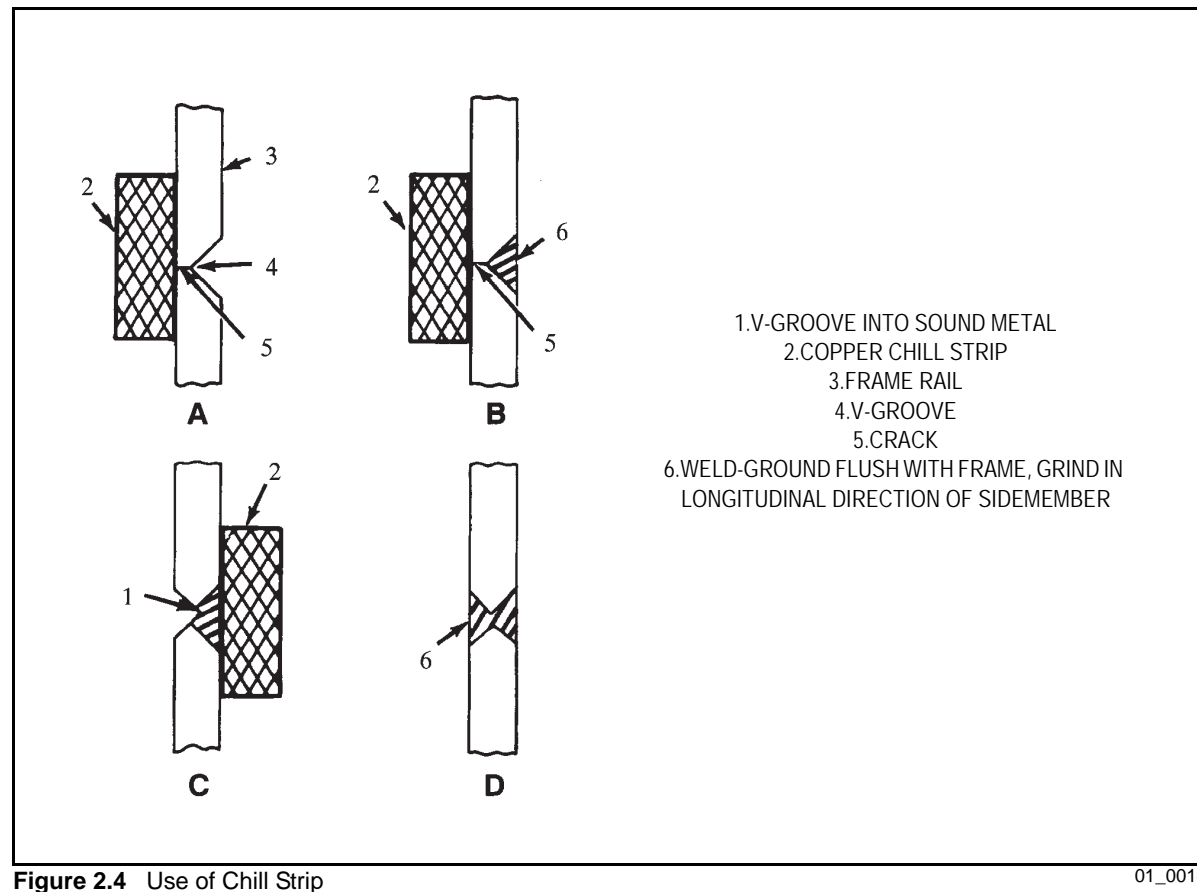
1. Welding should not be performed when surfaces are wet or exposed to rain, snow, high wind or when repair personnel are exposed to inclement conditions. Frames exposed to inclement weather must be thoroughly cleaned and dried before the repair is made.
2. Surface areas and edges to be joined must be clean and free of oil, grease, loose scale, rust, moisture, paint or other material that could contribute to poor quality welds.
3. Always avoid craters, notching and undercutting.
4. Peen new welds prior to grinding to relieve stresses caused by shrinkage.
5. Grind all welds flush with the surrounding surfaces. Use a coarse grinder followed by smooth grind at 90° to the crack direction to remove all of the coarse grind marks.
6. Inspect the weld repaired area carefully after grinding. Grind out any remaining cracks, notches or undercuts and repeat the finishing and inspections.
7. For welding cracks to the edge of the sidemember flange, locate a run-off block at the edge as in to obtain a continuous weld without undercuts. After welding, the run-off block should be cut off and the weld should be ground and inspected as in steps 5 and 6 above.
8. Weld to the edges of the holes: The weld should continue into the hole to form a plug weld with a copper chill block on the opposite side to help form the plug. The weld should then be finished as in steps 5 and 6 above and redrilled. Chamfer the hole edges. If the hole was open and unused, install a Grade 8 bolt to help attach the weld repair reinforcement.

Invisible ultraviolet and infrared rays emitted in welding can injure unprotected eyes and skin. Protection such as welder's helmet with dark colored filter lenses of the proper density must be used. GTAW or TIG welding will produce intense radiation, therefore, filter plate lenses of the deepest shade providing adequate visibility are recommended. It is strongly recommended that persons working in the weld area wear flash safety goggles. Also wear protective clothing.

9. Electrodes: Only low hydrogen electrodes should be used. These should be purchased in hermetically sealed containers or dried for two hours at a temperature between 450° F (232° C) and 500° F (260° C).

After drying, the electrodes should be stored in an oven at a temperature of at least 250° F (121° C). If exposed to the atmosphere for more than four (4) hours, the electrodes should be dried before use. **Any moisture introduced into the weld could develop porosity or embrittlement, leading to further cracking.** Welding procedures will vary among different frame materials. Outlined below are recommendations for welding of the various types of frames.

1. Preheat the frame member along the prepared weld joint to 500 to 600° F (260 to 316° C). Insure the area is clean and any moisture present is eliminated.
2. Permit heated area to cool to 200° F (93° C) or below before welding is started. The weld repair area must be clean before welding.
3. Either alternating current or direct current reversed polarity, combined with a short arc and beading or narrow weave technique, may be used. Direct current reversed polarity is recommended.
4. Slag should be removed after each pass and an interpass temperature of 200° F (93° C) should be maintained.
5. Grind smooth and flush with surrounding sidemember material. Grind the weld in a direction that is 90° to crack direction (Figure 2.4).
6. Add reinforcement.



### High Strength Low Alloy Steel Frames (50,000, 60,000 and 80,000 PSI Yield Strength)

Any of the electric arc methods previously described may be used. The choice of a suitable electrode or wire depends somewhat upon the equipment available for welding and the method selected.

The SMAW and the GMAW methods are preferred for welding the HSLA frames. The use of low hydrogen electrodes is recommended. Refer to Table 1.8 for selection of recommended electrodes and wires, or refer to A.W.S. A.5 standard available from [www.aws.org](http://www.aws.org) for equivalent strength electrodes, wires or rods and power leads to be used in the welding methods. The double V-notch weld preparation using the weld procedure shown in Figure 2.4 is the preferred welding method.

Table 1.8 Recommended Electrodes and Wires

Material Strength PSI	Recommended Electrode and Wire	
	SMAW	GMAW
50,000	E7018	E70S-3
60,000	—	E70S-1B
80,000	E8018	E80S-D2

Amperage and voltage recommendations for welding are shown in Table 1.10 and 1.11.

Table 1.9 SMAW Method (HSLA Frames)

Position	Electrode Sizes Inch	Welding Current		Speed (inch/min.)
		Amperes	Volts	
Flat	.125	—	—	—
Horizontal and Vertical	.125	110/140	20/14	24

Table 1.10 GMAW Method (HSLA Frames)

Position	Electrode Sizes Inch	Welding Current		Speed (Inch/Min.)
		Amperes	Volts	
Flat	.035	—	—	350/400
Horizontal and Vertical	.035	190/220	20/30	350/400

7. Preheat frame rail along the weld joint to 500 to 600° F (260 to 316° C) to insure any moisture present is eliminated and to prevent too rapid cooling of weld metal.
8. Direct current, reversed polarity is preferred. Weld using a short arc and a beading or narrow weave technique.
9. Slag should be removed after each pass and an interpass temperature of 200° F (93° C) should be maintained.
10. Grind smooth and flush with surrounding sidemember material. Grind the weld in a direction that is at 90° to crack direction (Figure 2.4).
11. Add reinforcement.

**Heat Treated Frames (if equipped; 110,000 and 120,000 PSI Yield Strength)**

When welding Heat Treated Frames (110,000 PSI and 120,000 Yield Strength), use low hydrogen electrodes which have superior crack resistance and notch toughness similar to AWS-E-11018. This type electrode should be stored in a moisture-free container to avoid porosity during welding.

Amperage and voltage recommendations for welding are shown in Table 1.11.

Table 1.11 SMAW Method (Heat-treated Frames)

Position	Amperes	Voltage
Downhand	130/140	21/23
Overhead	130/140	21/23
Vertical Up	110/120	22/24

A heavy copper “chill” strip should be clamped to the rail side away from the groove to help control the temperature and cooling rate during welding (Figure 2.4). Short lengths of discarded heavy copper electrical bus bars make suitable chill strips.

Preheat the frame rail along the crack area to 500-600° F (260-316° C). Either alternating current or direct current reversed polarity, combined with a short arc and a beading or narrow weave technique may be used. Direct current reversed polarity is recommended.

Slag should be removed after each pass and an interpass temperature of 200° F (93° C) should be maintained. Grind smooth and flush with surrounding sidemember material, in a direction that is parallel to the longitudinal axis of the sidemember (Figure 2.4).

A V-groove is ground from the side opposite the repair and the procedure outlined above repeated. “Chill” strips should be used whenever possible. The V-groove ground on the opposite side of the repair should be deep enough to enter the sound metal of the first weld repair as shown in Figure 2.4.

**Reinforcement**

The strength of the sidemember in the weld joint repair region has been reduced by welding and this region must be reinforced sufficiently to insure that the service life of the frame is not shortened. Reinforcement of the frame after welding is intended to reduce the stresses in the weld repair region to a lower level than was previously permitted. Improper drilling will also reduce the strength of the sidemembers. Refer to “Drilling or Notching”.

**The type, length, material and attachment techniques for reinforcements vary with the type and location of the crack and with the loading conditions associated with the crack.** It is not practical to give specific recommendations for all cases of frame cracking, therefore the various types of reinforcements are identified with general descriptions of their applications and installation procedures. To aid in making the distinctions between the more critical flange area and the less critical web area, critical zones are defined as shown (2.4).

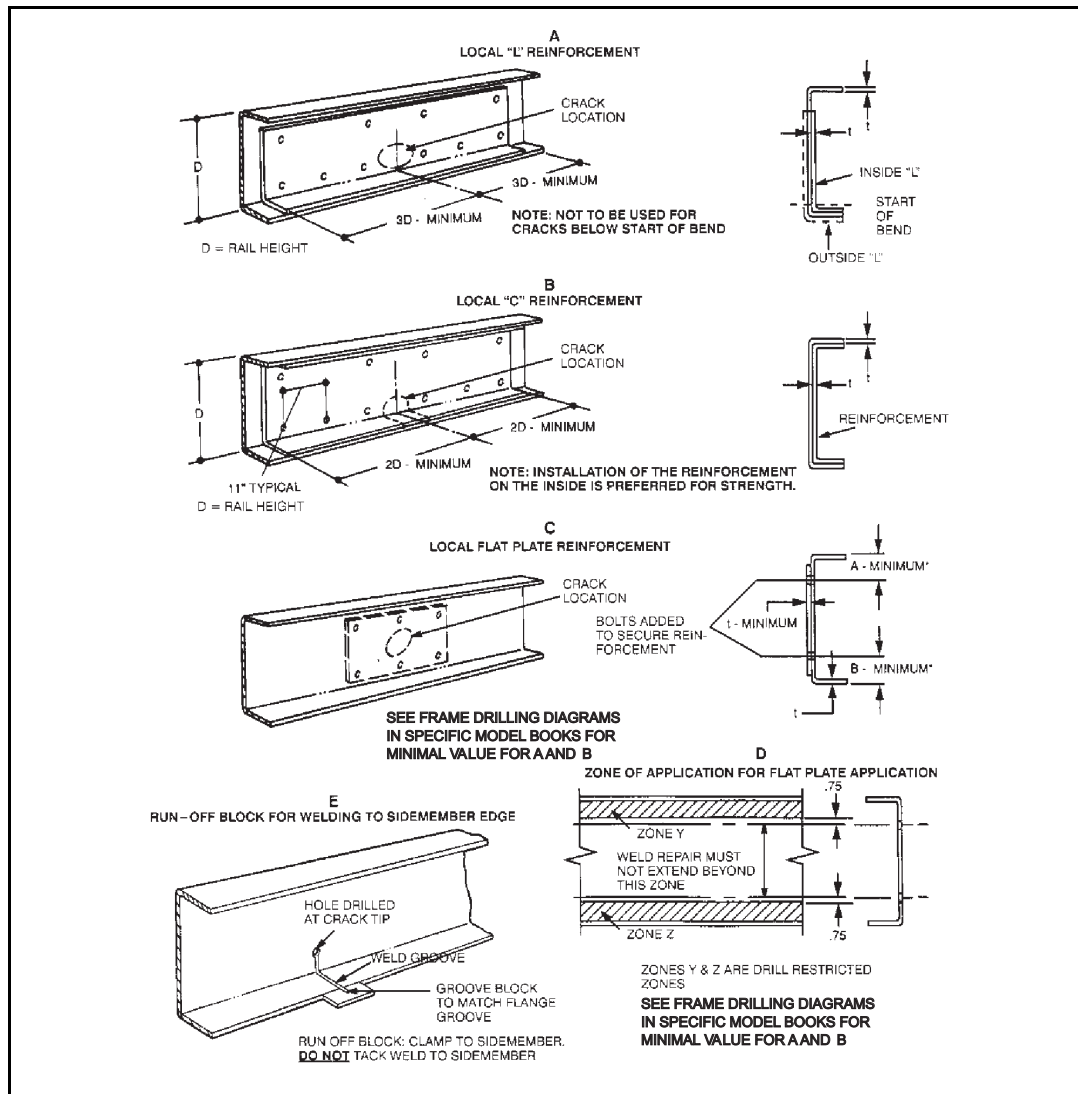


Figure 2.5 Reinforcement Application

01\_0015

Cracks which occur in the critical zones have a greater probability of growing vertically through the section, and the reduced strength after weld repair necessitates a more substantial reinforcement.

These guidelines potentially affect the structural integrity of the frame assembly and are intended for those who have the equipment and experience required to qualify as frame repair specialists.

### ***General Weld Repair Reinforcement Procedures***

1. The thickness and material strength of the local plate, “L” and channel reinforcements should match the section being reinforced.
2. The corners of the reinforcements which will be in contact with the sidemember along the reinforcement edges must be chamfered to prevent damage to the sidemember.
3. All sidemember reinforcements must be bolted to the web section within the zone shown in the frame drilling guidelines in the specific model body builder book. The bolts must be of SAE Grade 8 or better, with integral flanges or with hardened flat washers and must be tightened to Grade 8 levels.
4. Crossmember modification or replacement may be required if the reinforcement is on the same side as the crossmember.
5. Consider the potential effects of the reinforcements on the various components mounted to the frame. Check clearances for suspension, wiring, plumbing and other controls.
6. For attachment of reinforcements, use existing bolts wherever this is practical.
7. The weld repaired area of the sidemember and all of the reinforcement should be primed and painted before reinforcement installation. For corrosive environments, additional treatment of the interface may be needed.

### ***Full Length Channel Weld Repair Reinforcements***

“Full length” channel reinforcements are available through IC Bus™ dealers for most models. The actual length, starting location and ending location vary from model to model. Different length reinforcements may also be available.

When applied as a repair reinforcement, these reinforcements DO NOT increase the load capacity of the vehicle. Their advantage in this case is their availability. A disadvantage of this type is that it is likely to affect more of the components which mount to the frame. In some cases this disadvantage may be offset by cutting the full length reinforcement to create a local reinforcement.

### ***Recommended Applications***

1. Cases of repair of vertical cracks in either the top or bottom flanges at very low mileage.
2. Cases in which the weld repair is accompanied by extensive straightening of heat treated sidemembers.

**Full Length “L” Weld Repair Reinforcements**

Steps 1 and 2 above also apply to the full length “L” reinforcements available from IC Bus™. All of these are the inverted “L” type and are designed for installation on the outside of the sidemember section (except 9000 Series) (Figure 2.5).

**Recommended Applications**

This type of reinforcement is recommended for cases of cracking at very low mileage where a web crack has extended beyond the range for a flat plate reinforcement but ends short of the bend radius. It is also applicable to cases in which the cracking is accompanied by flange buckling.

**Application Procedures**

1. For custom-fabricated full length “L” reinforcements, the section should be oriented up or down so that the flange is on the same side as the damaged area.
2. For maximum strength the flange should be on the outside of the section.
3. Follow the general recommendations above for attachment of the reinforcement.

**Local Channel Weld Repair Reinforcements**

This type of reinforcement must be custom-fabricated either by cutting lengths from “full length” reinforcements or by forming from flat stock (Figure 2.5).

**Recommended Applications**

1. Cases in which the weld repair extends into the sidemember flange after substantial service life.
2. Cases accompanied by extensive abrasive wear of the sidemember section. In these cases the length of the wear area should be added to the length recommendations below.

**Application Procedures**

1. The channel should be installed on the outside of the section for greater strength.
2. Figure 2.5 gives recommended dimensional data and attachment specifications for a typical installation. Holes drilled for the attachment must be within the frame drilling guidelines in the specific model body builder book.

**Local “L” or Inverted “L” Weld Repair Reinforcements**

This type of reinforcement is also generally custom-fabricated. It has a greater tendency to loosen than a channel reinforcement because, for vertical deflections of the frame assembly, it tends to bend about an axis different from that of the main sidemember section. Because of this its length and/or attachment specifications are typically greater than for the channel type.

**Recommended Applications**

This type of reinforcement is recommended for cases in which the weld repair is confined to the web of the section but extends beyond the application zone of the flat plate reinforcements shown in Figure 2.5.

**Application Procedures**

1. Figure 2.5 shows a typical installation for an “L” reinforcement on the inside of a sidemember section along with minimum recommended dimensions.
2. The flange of the reinforcement should be oriented up or down so that flange is on the same side as the damaged area.
3. For maximum strength the reinforcement should be installed on the outside of the sidemember section.

***Flat Plate Weld Repair Reinforcements***

This reinforcement is intended for the less critical, web portion of the sidemember section where typical cracking is due to local stresses which tend to “diaphragm” or “dish” the web without creating appreciable stresses for overall bending of the section. Typical crack patterns radiate out from the edge of a mounting bracket or crossmember or from a hole in the web. Cracks which radiate from a web hole occupied by a fastener are frequently an indication of a defective joint, whether by the loosening of the fastener or poor joint design (Figure 2.5).

**Recommended Applications**

The flat plate reinforcements are recommended for weld repairs in which the weld does not extend beyond the zone defined in (Figure 2.5).

**Application Procedures**

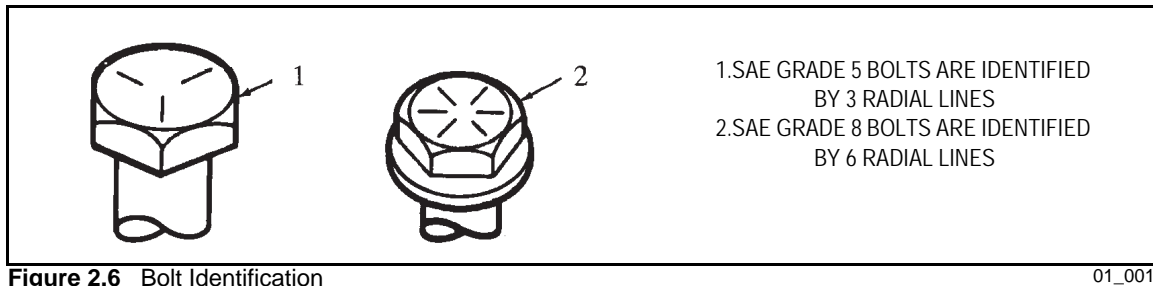
1. A typical installation is shown in Figure 2.5. The length and height of the plate will vary with the size of the weld repair area. In general it should be such that it will accommodate an array of reinforcement attachment bolts at a typical 3 to 5 inch (76 to 127 mm) spacing all around the weld repair area.
2. The plate should generally be installed on the side opposite the component which transferred the local bending load into the web.
3. The edges of the plate should be staggered with respect to the edges of other relatively stiff web mounted components to avoid the creation of stress concentrations.

## Bolt and Torque Information

Most frames are assembled with bolts and nuts. Others are riveted. **Bolts must always be used when attaching a reinforcement.** Rivets should be replaced by bolts as required when the frame is repaired and reinforced.

In bolted joints, the majority of the load is transferred by frictional force or clamping force between the members of the joint. The bolts must be properly tightened to develop and maintain the desired clamping force. Operation of the joint with loose or improperly tightened bolts can lead to failure of the joint. The bolts and nuts should be inspected periodically to insure that proper torque is maintained.

Bolts of high strength material conforming to SAE Grade 8 bolts should be used on all frames. For installation of reinforcements, 0.5 inch (13 mm) diameter flange head bolts are recommended. The SAE Grade 8 bolt is identified by six radial line markings on the head of the bolt (Figure 2.6). Nuts must be Grade 8 flange type.



These bolts, 0.5 inch (13 mm) diameter flange head type, should be tightened to 110 to 120 ft-lbs. (149 to 163 Nm) based on new bolts and nuts lubricated with engine oil. Whenever possible, hold the bolt and tighten the nut.

If frame components are aluminum, flange head bolts and nuts, or bolts with hardened flat washers must be used. If modification or repair requires replacement of existing bolts with new bolts or bolts of a greater length, the old flange head nuts should not be used with new standard bolts.

Careful consideration is given to the number, location and sizes of frame bolt holes in the design of a vehicle. The number, location and sizes of additional bolt holes put in the frame subsequent to manufacture of the vehicle can adversely affect frame strength. The adverse effect of additional bolt holes can be minimized by following the guidelines.

### **Huckbolt Fasteners (HP 8)**

Huckbolt HP 8 fasteners are used in various positions in frame rail construction. Advantages to this style fastener are consistent clamp load and a high resistance to loosening due to vibration. The need to recheck fastener torque is eliminated.

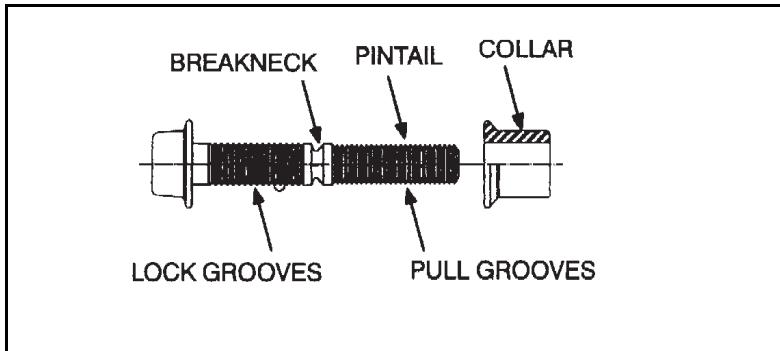


Figure 2.7 Huckbolt Fasteners

01\_0017

### **Removal**

The swaged collar cannot be unscrewed due to the locking grooves on the HP 8 fastener. Removal requires a Huck Collar Cutter or the collar can be split with an air chisel while supporting the opposite side of the collar. When the collar is split, the fastener can be driven out with a punch.

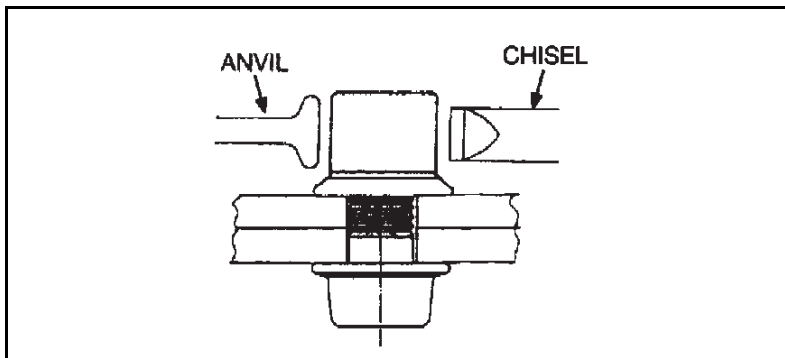


Figure 2.8 Collar Can Be Split With an Air Chisel

01\_0018

**CAUTION:** The HP 8 fastener is not intended for re-use. To do so can result in damage to the vehicle frame or components attached to the frame.

**CAUTION:** In the event that Huck fasteners are removed, in order to retain the same joint integrity, it is strongly recommended that new Huck fasteners be used for attachment/reattachment of components.

### Installation

**NOTE:** Huckbolt HP 8 fasteners cannot be installed without Huck installation equipment.

1. Install the HP 8 fastener into the component and frame hole.
2. Place the collar over the fastener pintail (See Figure 2.9)

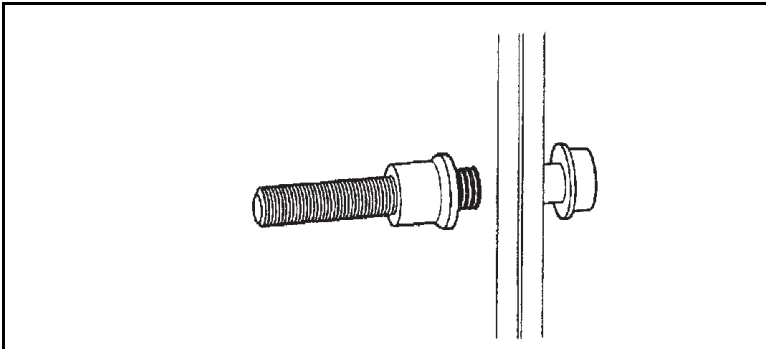


Figure 2.9 Place Collar Over Fastener Pintail

01\_0019

3. Place the Huck installation tool over the HP 8 fastener pintail (See Figure 2.10).

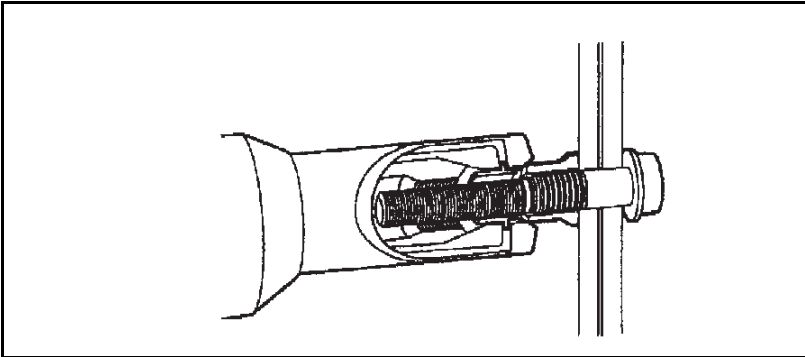


Figure 2.10 Place Installation Tool Over Fastener Pintail

01\_0020

4. Activate the Huck installation tool.

**NOTE:** The Huck installation tool creates a pulling force on the fastener, seating the bolt head and closing the gap between the mating surfaces. The collar is swaged into the pintail locking grooves developing clamping force (See Figure 2.11). As pulling forces further increase, the body of the fastener separates at the breakneck (See Figure 2.12), completing installation.

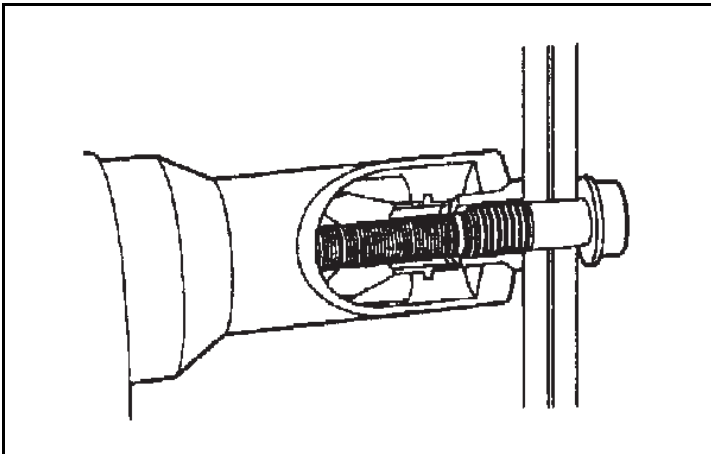


Figure 2.11 Clamping Force is Developed

01\_0021

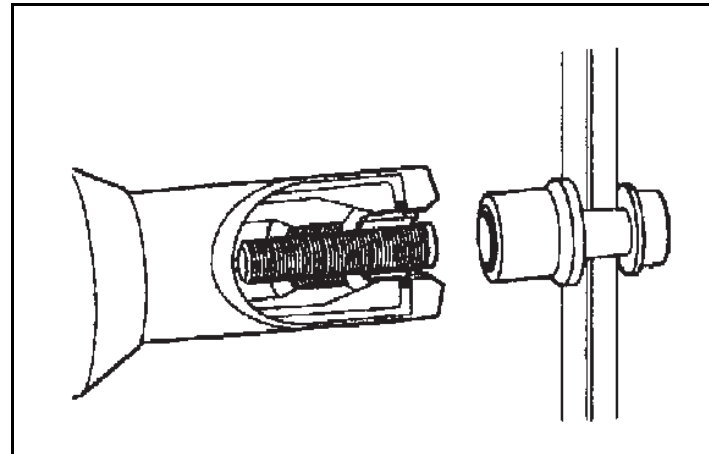
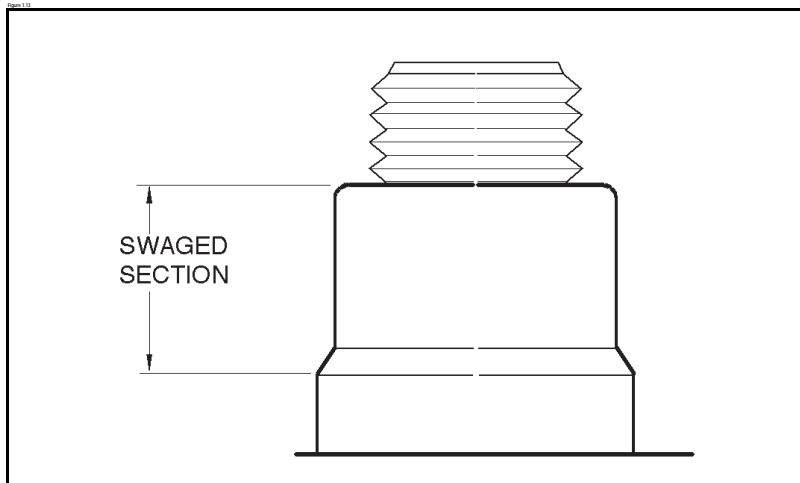


Figure 2.12 Body of Fastener Separates at Breakneck

01\_0022

**Huck-Spin Fasteners****Description**

Huck-Spin fasteners are used in various positions in frame rail construction. The installed fastener has a collar that is cold-worked or swaged over the grooved pin Figure 2.13. Advantages to this style fastener are consistent clamp load and a high resistance to loosening due to vibration. The need to recheck fastener torque is eliminated.



**Figure 2.13** Huck-Spin Collar

01\_0023

**Remove**

The collar cannot be removed by twisting or hammering. The collar must be cut longitudinally to the extent of the swaged section. This can be accomplished with a small wheel grinder (Figure 2.14).

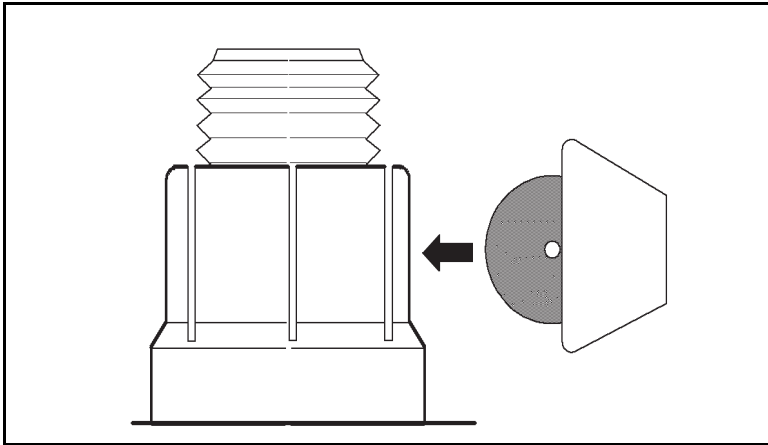


Figure 2.14 Cutting Collar with Wheel Grinder

01\_0024

Drilling on opposite sides of the collar may also be used (Figure 2.15).

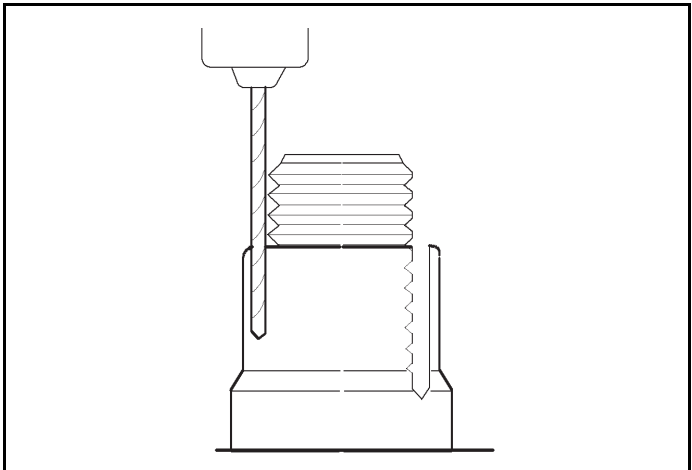
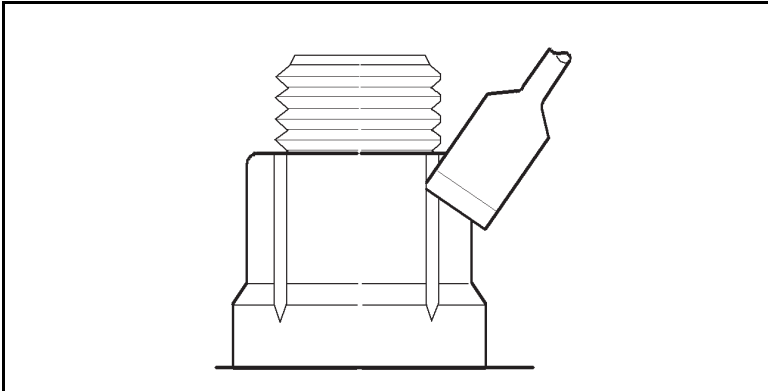


Figure 2.15 Drilling the Collar

01\_0025

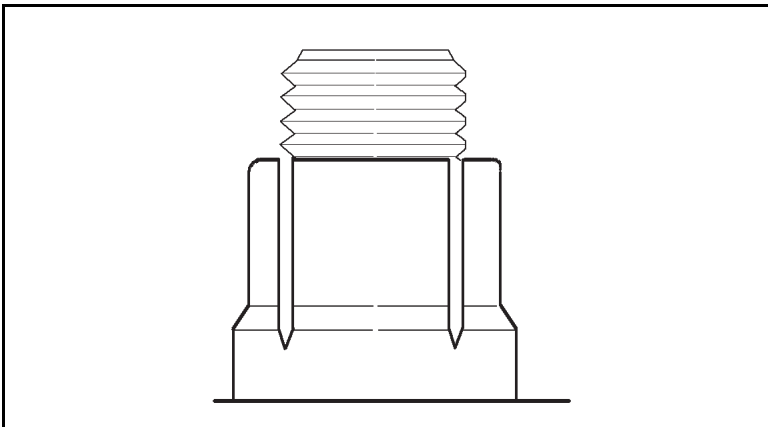
Another method of splitting the collar is to chisel the walls of the collar (Figure 2.16).



**Figure 2.16** Using a Chisel to Split the Collar

01\_0026

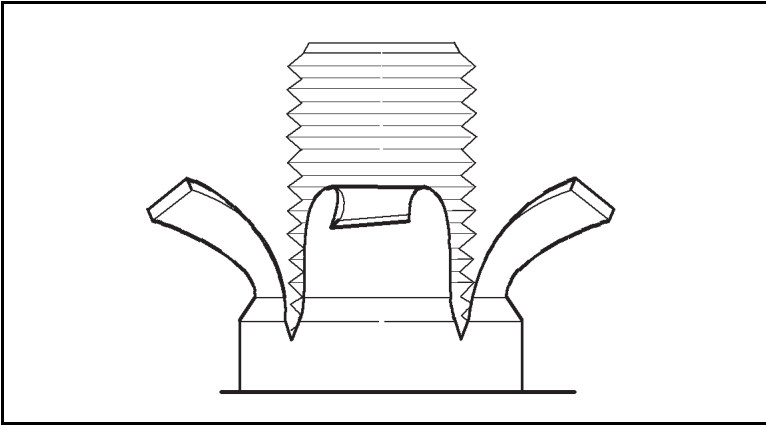
When the collar has been opened over the length of the swaged portion on two opposite sides (Figure 2.17), the fastener can be removed. The fastener may need to be hammered to remove the collar.



**Figure 2.17** Collar with Reliefs for Removal

01\_0027

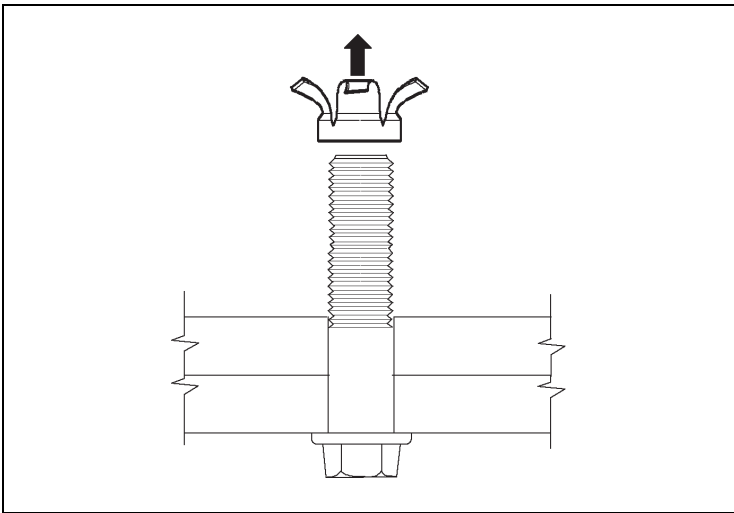
In the event the collar doesn't come loose, use a chisel or suitable tool to peel the collar sections back (Figure 2.18).



**Figure 2.18** Collar Peeled Back to Assist Removal

01\_0028

The fastener will come free when sufficient collar material has been pulled away (Figure 2.19).

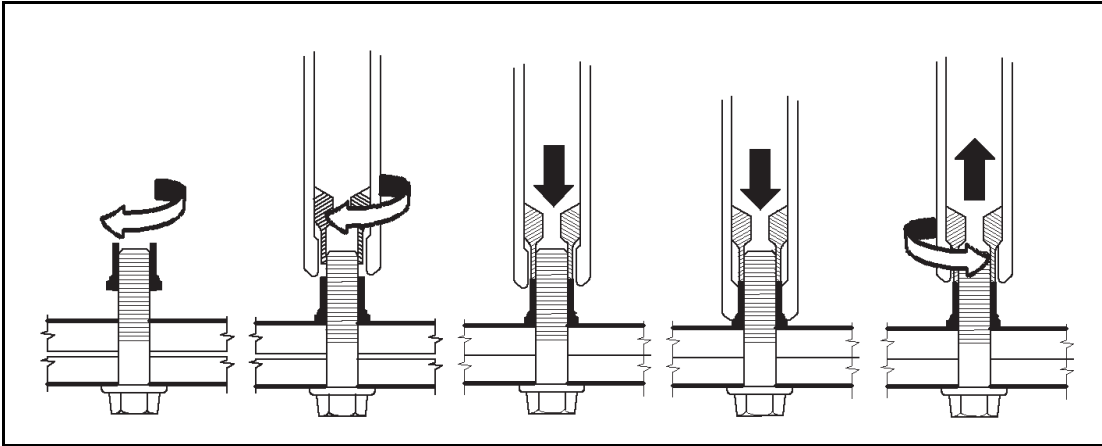


**Figure 2.19** Fastener Removed

01\_0029

**Install**

The Huck-Spin is installed by spinning the collar onto the fastener. The pulling action of the Huck-Spin installation tool swages the collar into the grooves of the fastener and then automatically disengages from the fastener (Figure 2.20).



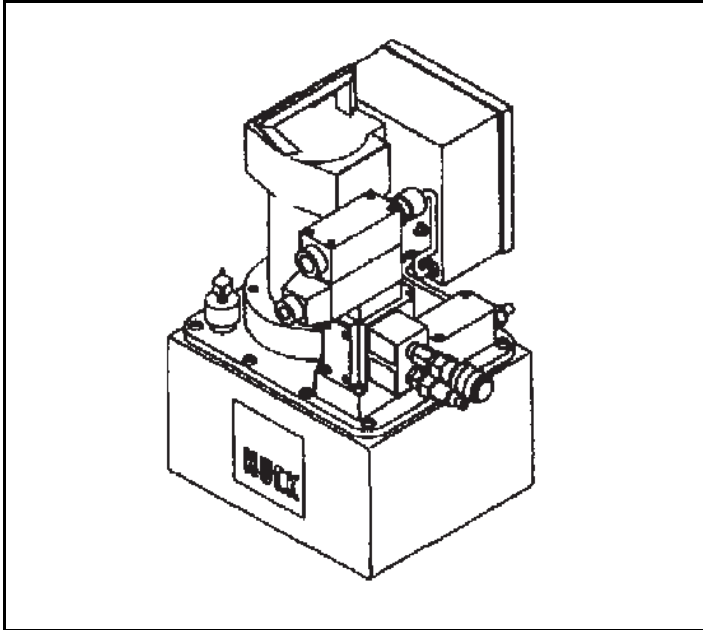
**Figure 2.20** Huck-Spin Installation

01\_0030

## Special Service Tools

### ***Hydraulic Unit – Model No. 940***

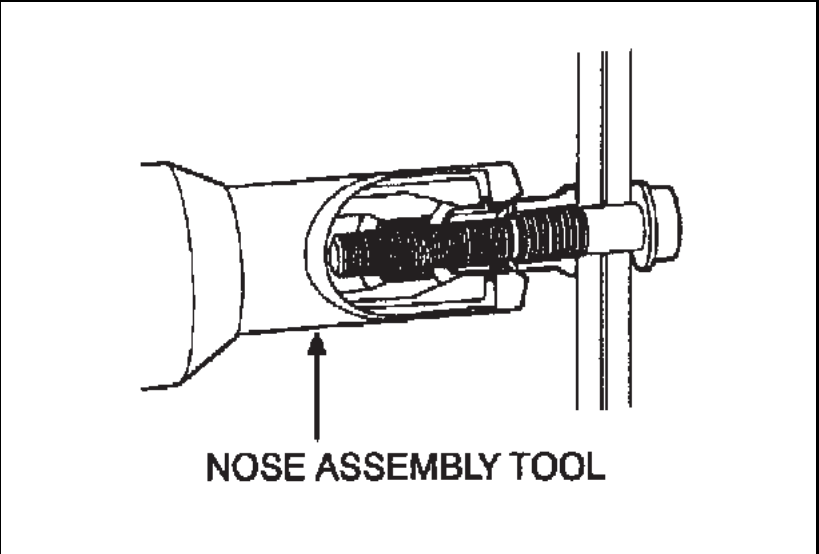
Used for removal and installation of the Huck Bolt.



**Figure 2.21** Hydraulic Unit

01\_0031

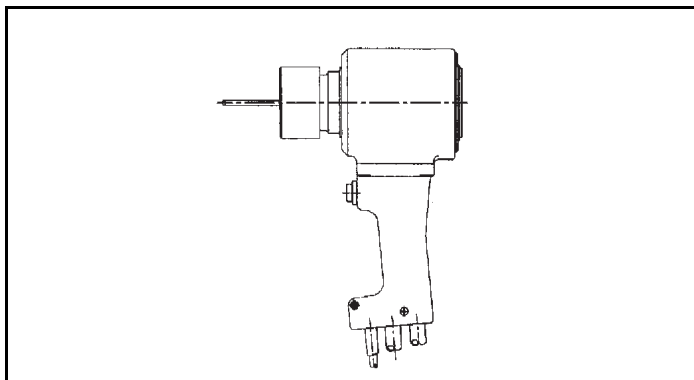
***Nose Assembly Tool***



**Figure 2.22** Nose Assembly Tool 01\_0032

Table 1.12 Nose Assembly Tool

Description	Tool Number
For 1/2 Dia. Fastener	99-1484
For 5/8 Dia. Fastener	99-1481

**Hydraulic Installation Tool****Figure 2.23** Hydraulic Installation Tool

01\_0033

**Table 1.13** Hydraulic Installation Tool

Description	Tool Number
For 1/2 Dia. Fasteners	557
For 5/8 Dia. Fasteners	585

**Collar Removal Tool****Table 1.14** Collar Removal Tool

Description	Tool Number
For 1/2 Dia. Fasteners	516
For 5/8 Dia. Fasteners	520

**Order tools from:**

Huck International, Inc.	Phone: (914) 331-7300
P.O. Box 2270, One Corporate Drive	Fax: (914) 334-7333
Kingston, NY 12401	

### After-Market Modifications

Cutting the frame behind the rear axle to shorten the frame is acceptable. Mechanical cutting or sawing is preferred to torch cutting. Whenever it is necessary to cut the frame, the sidemember should be cut at an angle of 90° to the longitudinal axis.

For information on cutting of the frames to lengthen the frames or modify the wheelbase, refer to “Wheelbase Alterations”.

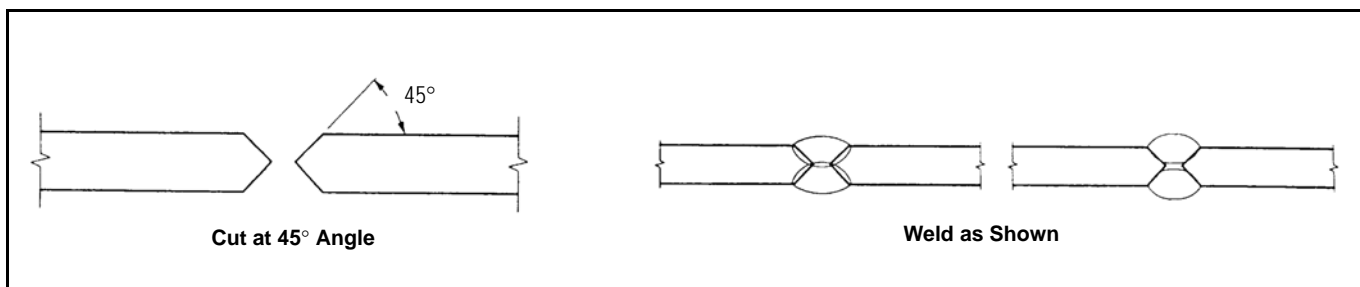
The addition or installation of this special equipment on the vehicle can significantly affect the loading of the chassis frame. In some cases, it may be necessary to reinforce the frame. Care must be exercised to insure that the gross vehicle weight rating (GVWR) and/or the gross axle weight ratings (GAWR) are not exceeded.

Installation of this special equipment may involve State and Federal requirements which affect vehicle certification for noise emissions, exhaust emissions, brake requirements, lighting system requirements, etc. The specialized equipment installer is responsible for the safety and durability of their product and, in addition, is responsible to insure that the equipment and its installation comply with all applicable State and Federal Department of Transportation requirements and OSHA regulations.

Addition of specialized equipment may have a significant effect on other vehicle components, such as the brake system, steering system, suspension system, etc. Simple reinforcement of the chassis frame may not be adequate to provide safe operation of the vehicle.

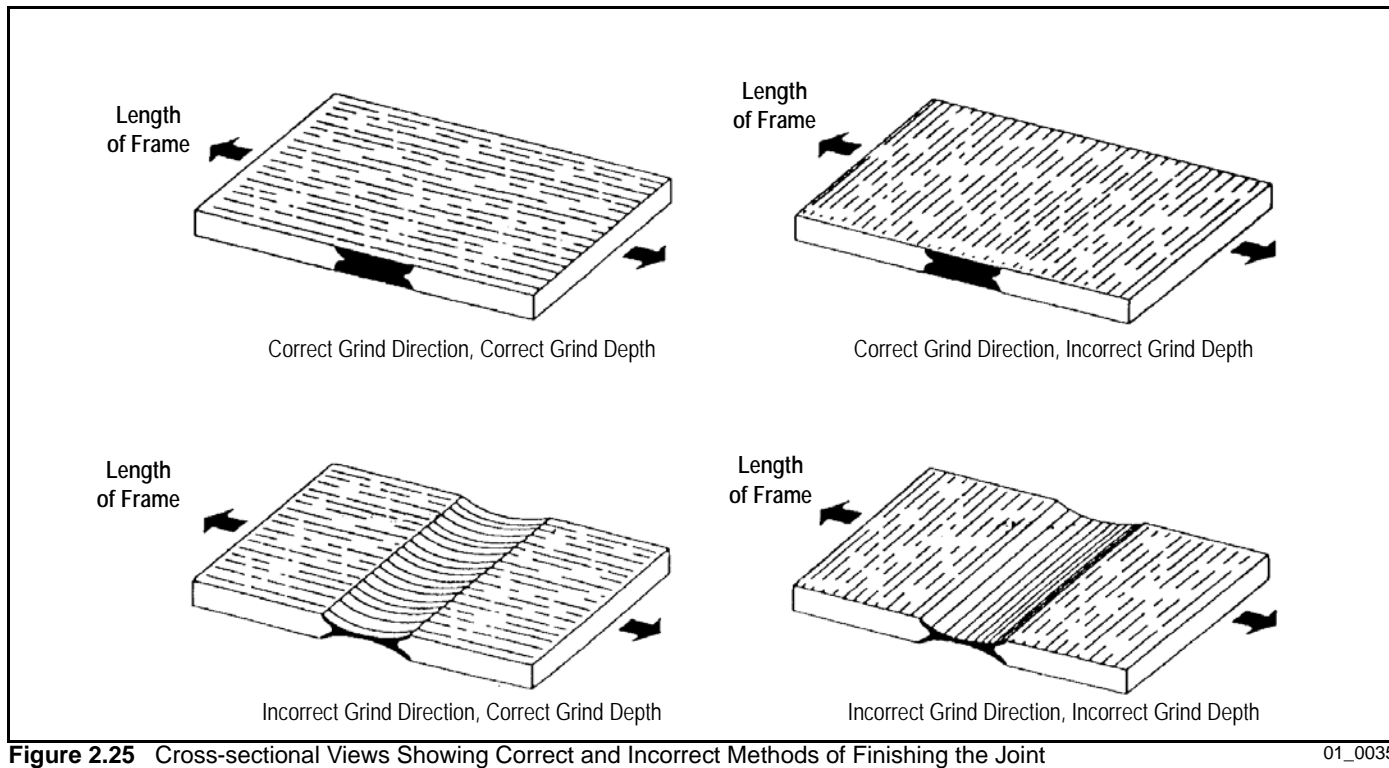
In any modification of the chassis frame, the addition of holes, reinforcements, welds, clamps, splices, etc. may cause an increase in the local stress in the frame at the point of the modification. These local stress concentrations can significantly affect the life of the chassis frame. The specific effect which the stress concentrator will have on the life of the chassis frame is influenced by the location of the stress concentration, the frequency and severity of the loading, and the type of stress concentration. Any modification of the frame may void the manufacturer's warranty.

Refer to “Welding and Reinforcement” information on page 30.



**Figure 2.24** Frames – Preparation of Joint for Welding Extension

01\_0034



**Figure 2.25** Cross-sectional Views Showing Correct and Incorrect Methods of Finishing the Joint

## Wheelbase Alterations

Shortening or lengthening a wheelbase is an added expense for the customer. Therefore, it is often to the customer's benefit to order a chassis from the factory with the desired wheelbase rather than to alter the wheelbase of the chassis on-site.

The preferred method for altering the wheelbase is to slide the rear axle forward or rearward as required. Invariably, this requires the lengthening or shortening of air lines, brake lines, electrical lines, and driveline. Extreme care should be taken in the modification of the air lines, brake lines, electrical lines and driveline to insure that they operate as reliably as those with which the vehicle was manufactured.

If the wheelbase is lengthened, a reinforcement may be required. Consult your IC Bus™ dealer before lengthening the wheelbase.

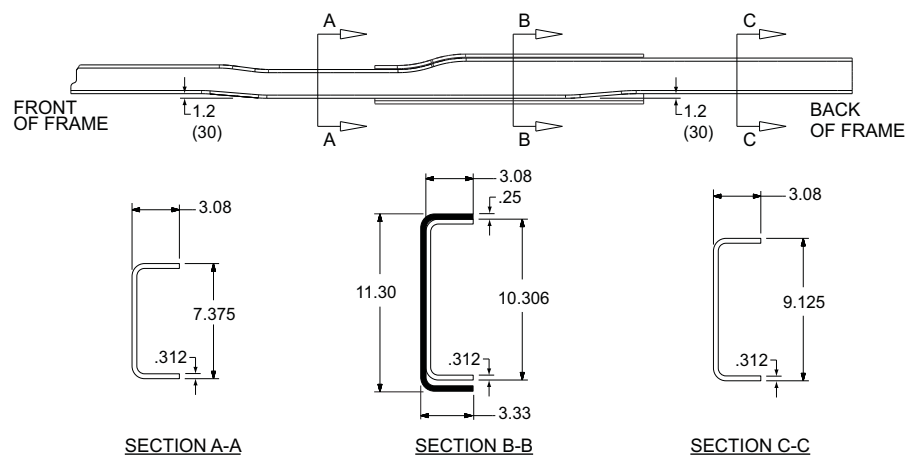
In those instances when it is necessary to cut and weld the frame to alter the wheelbase, the frame must be reinforced with a channel-type reinforcement of the same strength as the original frame material in the area where the frame has been cut, extending at least two feet on either side of the cut and bolted as specified in Figure 2.5 shown earlier in this section.

If the frame was built with both a main frame and a reinforcement, the reinforcement should be removed before cutting the main frame. **It is essential that a new one-piece outer channel reinforcement be obtained rather than cutting and re-using the original reinforcement.** The original frame should also be reinforced with an inner channel reinforcement, extending at least two feet beyond the cut(s) on either side of the cut(s). The reinforcement must be of the same material as the original frame. Blank and pre-punched chassis channel reinforcements are available through your dealer parts department.

On both medium and high strength aluminum frames, **re-welding to lengthen the frame is not recommended.** Refer to “Reinforcement” and “Reinforcement Attachment” for additional information.

## MODEL 4x2

### Frame Rail Specifications/Cross-Section



01\_0240

Section	Side Rail Descriptions & <i>Reinforcement</i> Description <sup>[2]</sup>								
	Dimensions (inches)			Yield Strength Nominal (psi)	Material #	Section Modulus <sup>[1]</sup> (inches <sup>3</sup> )		Resisting Bending Moment (In.-Lbs.)	
	Depth	Width	Thickness			Maximum	Nominal	Maximum	Design
Drop Center Side Rail — Kick-Up at Rear Suspension Rearward									
A-A	7.375	3.08	0.312	80,000	B	8.68	8.08	694,700	646,000
B-B	10.306	3.08	0.312	80,000	B	26.05	24.17	2,084,000	1,933,000
	11.30	3.33	0.25	80,000	B				
C-C	9.125	3.08	0.312	80,000	B	11.70	10.93	935,800	874,000

B = High Strength Low Alloy Steel

[1] = **Section Modulus:**

**Maximum Tolerance:** All frame dimensions are at maximum tolerance; used by some competitors as advertised values.

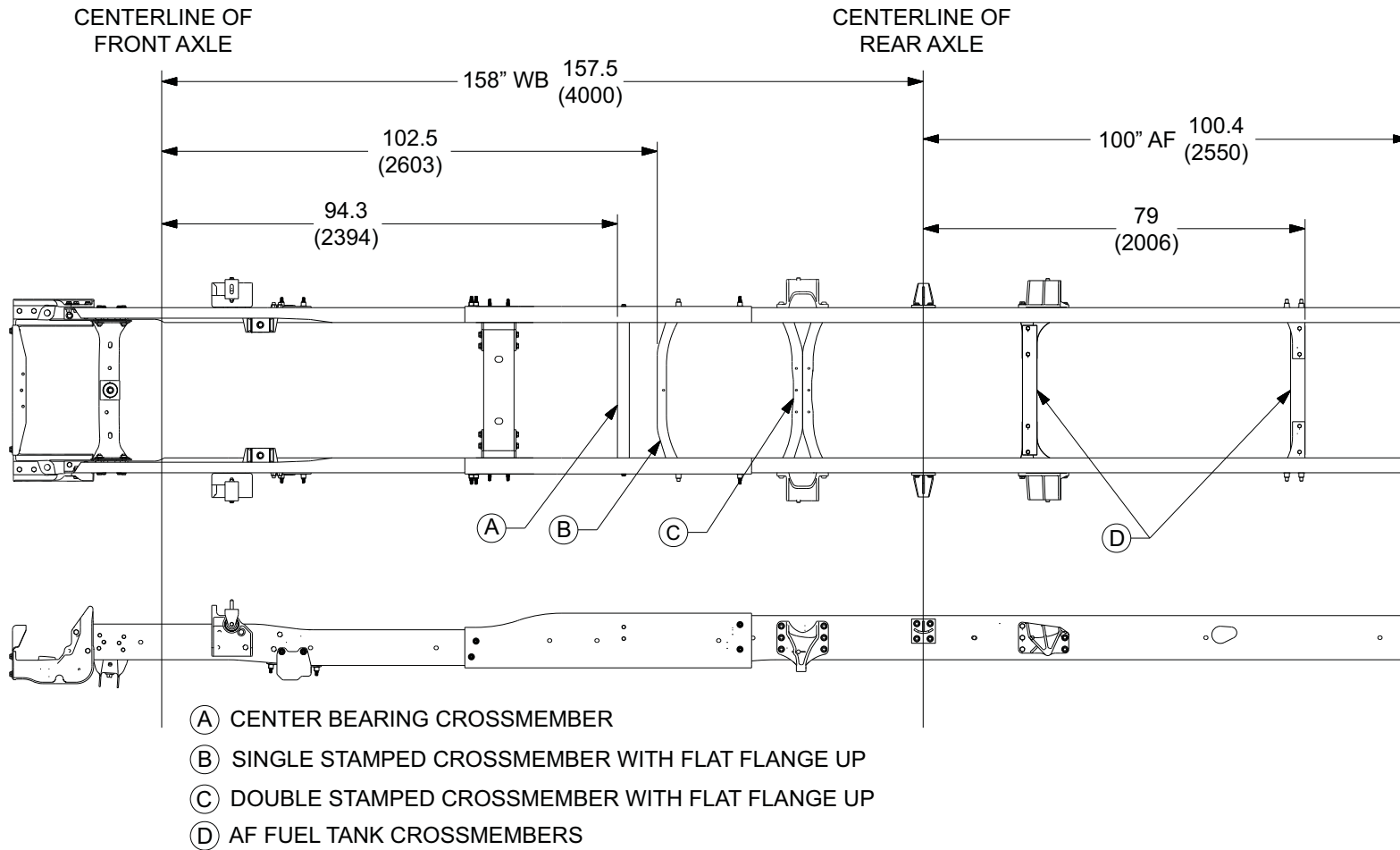
**Nominal:** Calculated using design dimensions – indicates the design load capacity of the frame.

[2] = Reinforcement dimensions and specifications are shown in *italics*

## MODEL 4x2

### Crossmembers

#### Crossmember Location - 158" Wheelbase (WB)

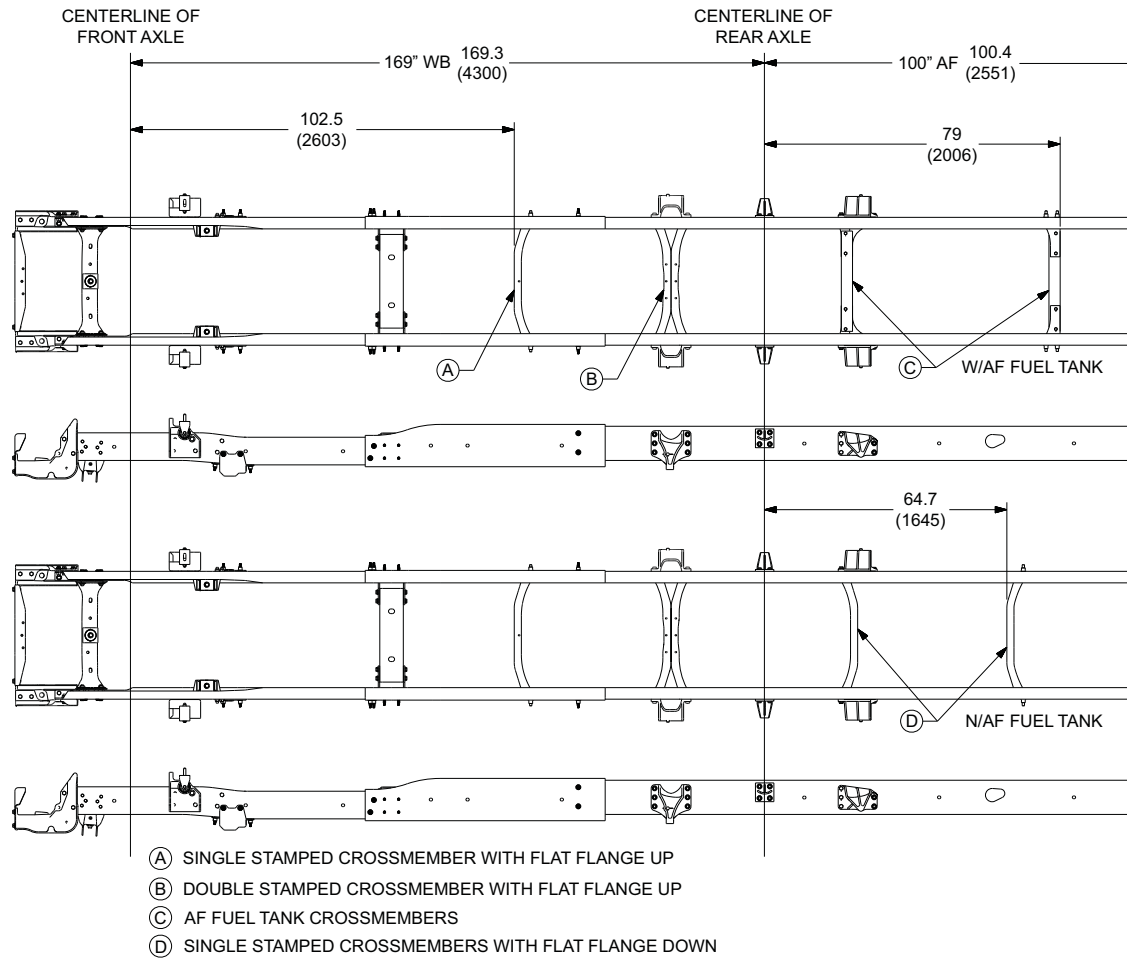


UC\_crossmembers\_158wb

## MODEL 4x2

### Crossmembers

#### Crossmember Location - 169" Wheelbase (WB)

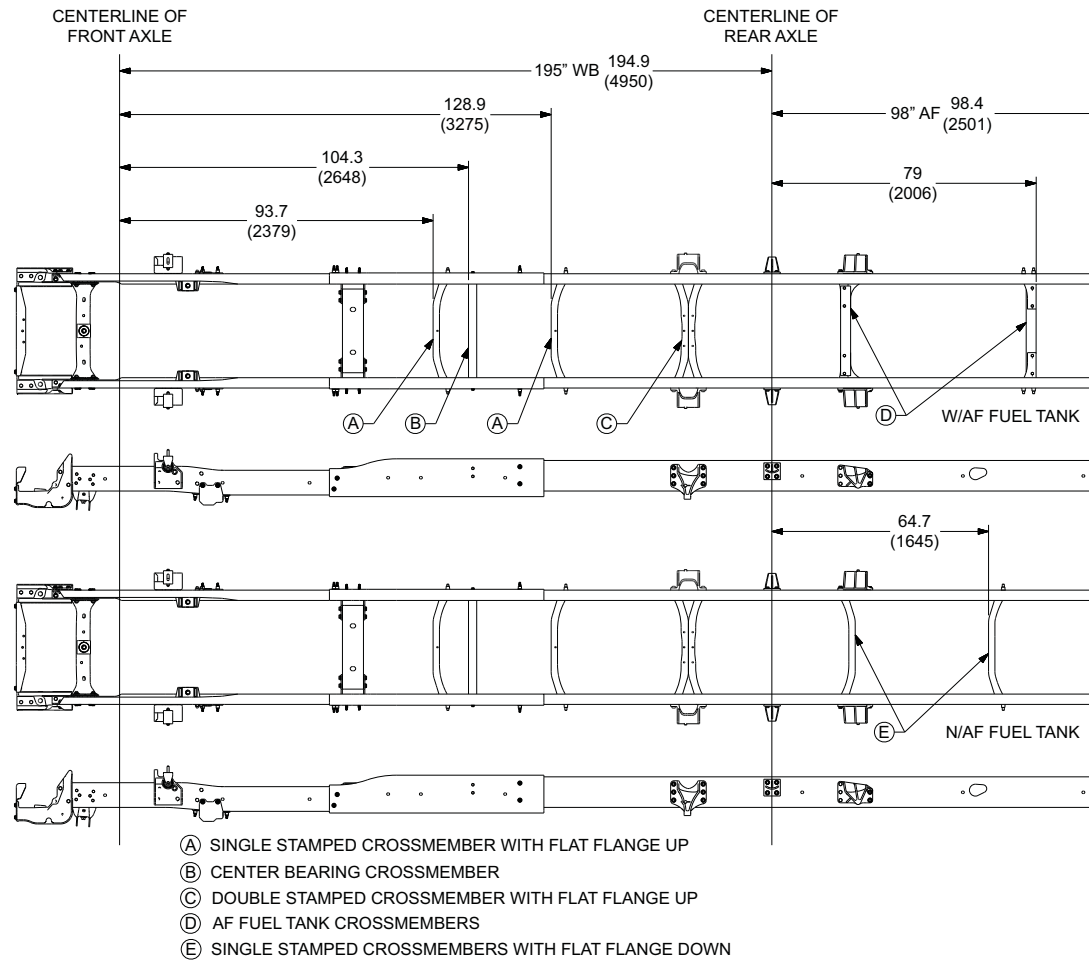


UC\_crossmembers\_169wb

## MODEL 4x2

### Crossmembers

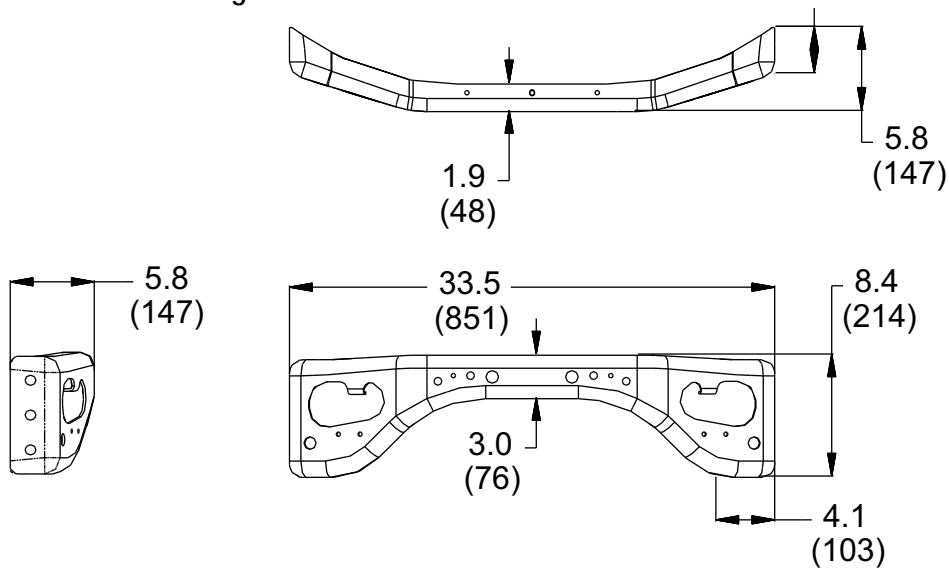
#### Crossmember Location - 195" Wheelbase (WB)



UC\_crossmembers\_195wb

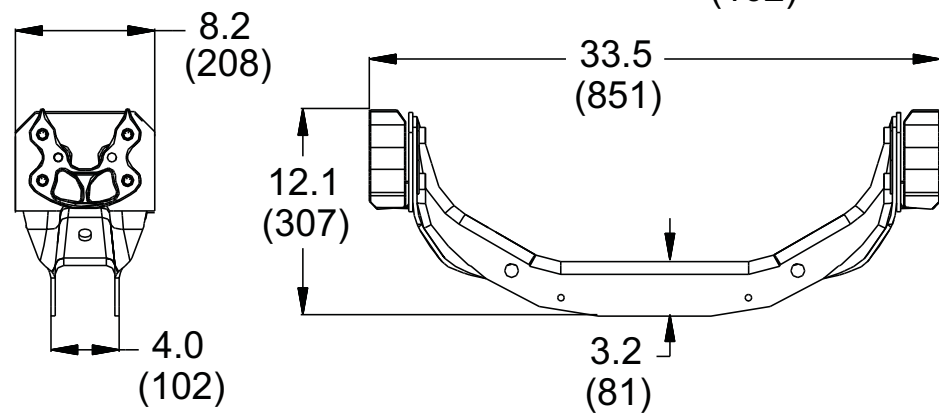
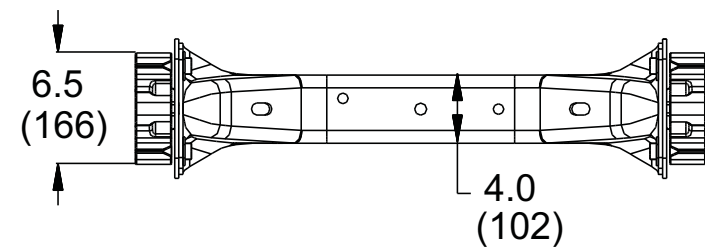
## MODEL 4x2

### Crossmember Diagrams



**SINGLE CROSSMEMBER**

**ENGINE CROSSMEMBER**

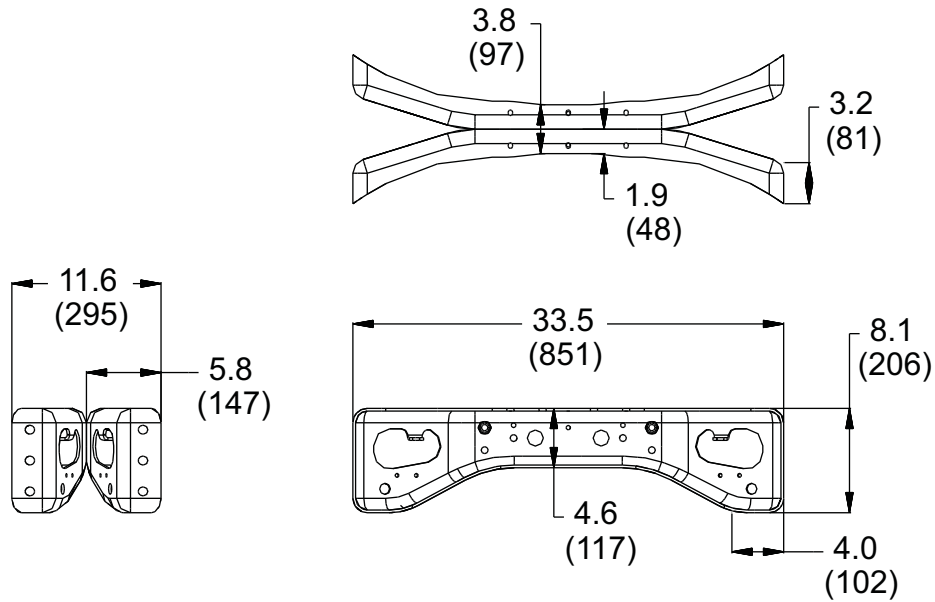


01\_0246

01\_0247

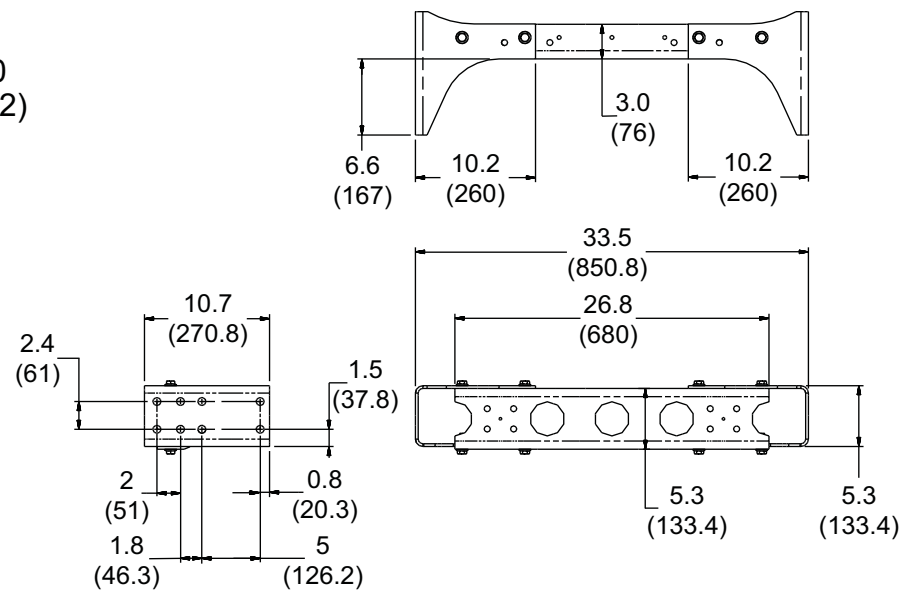
## MODEL 4x2

### Crossmember Diagrams (continued)



**DOUBLE STAMPED CROSSMEMBER**

### "C" CHANNEL AF AND BTR FUEL TANK CROSSMEMBER



UC\_btr\_crossmember

01\_249

## MODEL 4x2

### Frame Drilling Guidelines

The drilling of the frame sidemember presents no unusual difficulty. Standard high speed steel drills of good quality will serve provided they are sharpened properly and not overheated during sharpening or use.

#### Hole Location Guidelines

1. Never drill holes into the restricted areas of the frame rails. Refer to diagrams on the following pages.
2. Use existing holes whenever possible.
3. Maintain a minimum of 0.75 inch (19 mm) of material between holes.
4. There should not be more than three holes located on a vertical line.
5. Bolt holes should be no larger than is required for the size of bolts being used, in no instance larger than 11/16 (.688 inch).
6. If reinforcements are used, avoid drilling holes closer than 2.0 inches (51 mm) from the ends of the reinforcement.
7. Bolts must be periodically checked to insure that the proper torque and clamping force is maintained.
8. Never drill any holes in the flanges of the frame rail.

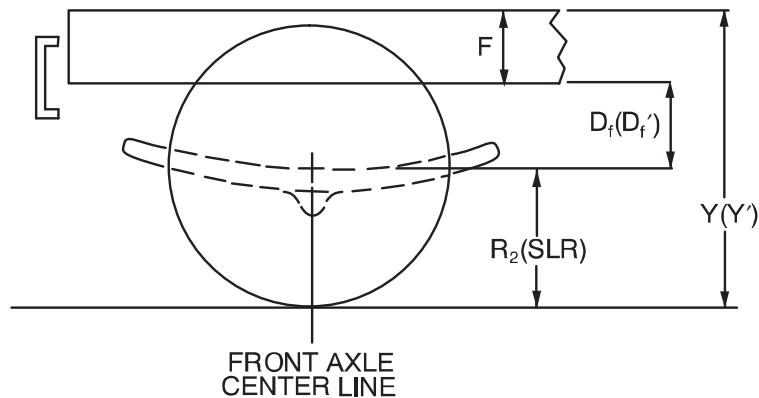


## MODEL 4x2

### Frame Height Calculations

#### At Centerline of Front Axle

The front frame height (at the centerline of the front axle) may be calculated using the following equations. Refer to the illustration for a visual explanation of the symbols used in these calculations



01\_0045

- $D_f$**  = Wheel axis to bottom of frame in unladen position. Refer to tabulated data.
- $D_f'$**  = Wheel axis to bottom of frame in loaded position. Refer to tabulated data.
- $F$**  = Frame rail height. Refer to tabulated data.
- $SLR$**  = Static Loaded Radius. The distance from the wheel axis to the ground for a properly inflated, fully loaded (loaded to its maximum capacity) tire. To obtain tire dimensions, contact the tire manufacturer.
- $R_1$**  = Tire Radius (one half of tire outside diameter) **not** mounted on the vehicle. To obtain tire dimensions, contact the tire manufacturer.
- $R_2$**  = Calculated Tire Radius on an unloaded chassis. The value of  **$R_2$**  is calculated using the following method.

$$R_2 = R_1 - .2(R_1 - SLR)$$

- $Y$**  = Front Frame Height at the front axle centerline in unloaded condition.
- $Y'$**  = Front Frame Height at the front axle centerline in loaded condition.

$$Y = D_f + R_2 + F \quad (\text{for unloaded condition})$$

$$Y' = D_f' + SLR + F \quad (\text{for loaded condition})$$

**NOTE:** Values calculated for  **$Y$**  and  **$Y'$**  are strictly for the frame height at the front axle centerline. For frame heights at the front of the frame rail, refer to “**Model 4x2**” on page 74 in this book.

## MODEL 4x2

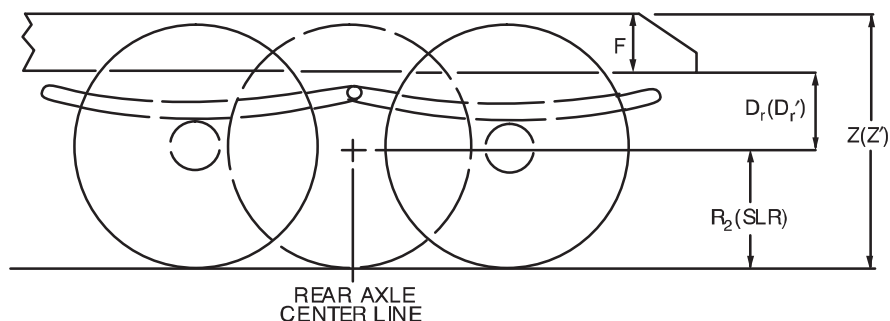
### Frame Height Data – Front

Front Suspension			Spindle to Bottom of Frame	
Type	Capacity	Code	Unloaded – $D_f$	Loaded – $D_f'$
Parabolic	6,000-lb	03AGP	5.42"	3.92"
	7,000-lb	03AGN		3.42"

## MODEL 4x2

### At Centerline of Rear Axle

The rear frame height (at the centerline of the rear axle) may be calculated using the following equations. Refer to the illustration for a visual explanation of the symbols used in these calculations.



01\_0046

- D<sub>r</sub>** = Wheel axis to bottom of frame in unladen position. Refer to tabulated data.
- D<sub>r</sub>'** = Wheel axis to bottom of frame in loaded position. Refer to tabulated data.
- F** = Frame rail height. Refer to tabulated data.
- SLR** = Static Loaded Radius. The distance from the wheel axis to the ground for a properly inflated, fully loaded (loaded to its maximum capacity) tire. To obtain tire dimensions, contact the tire manufacturer.
- R<sub>1</sub>** = Tire Radius (one half of tire outside diameter) **not** mounted on the vehicle. To obtain tire dimensions, contact the tire manufacturer.
- R<sub>2</sub>** = Calculated Tire Radius on an unloaded chassis. The value of **R<sub>2</sub>** is calculated using the following method.

$$R_2 = R_1 - .2(R_1 - SLR)$$

- Z** = Rear Frame Height at the rear axle centerline in unladen condition.
- Z'** = Rear Frame Height at the rear axle centerline in loaded condition.

$$Z = D_r + R_2 + F \quad (\text{for unladen condition})$$

$$Z' = D_r' + SLR + F \quad (\text{for loaded condition})$$

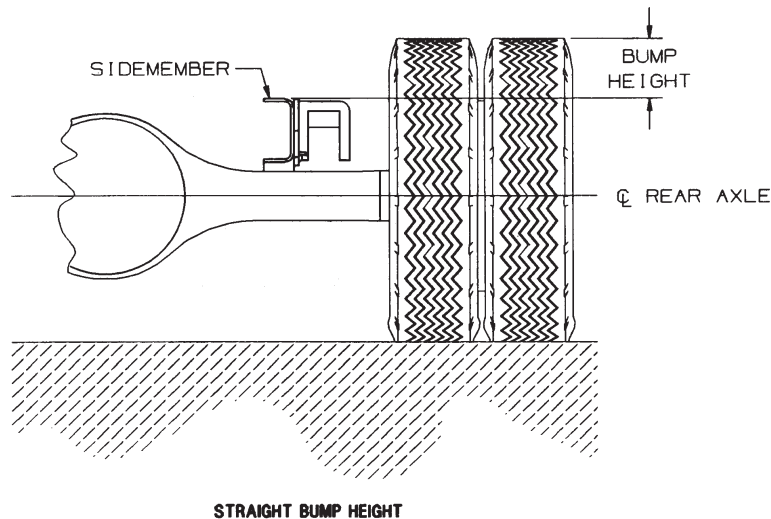
**NOTE:** Values calculated for **Z** and **Z'** are strictly for the frame height at the rear axle centerline. For frame heights at the rear of the frame rail, refer to “**Model 4x2**” on page 74 in this book.

## MODEL 4x2

### Bump Heights – Rear

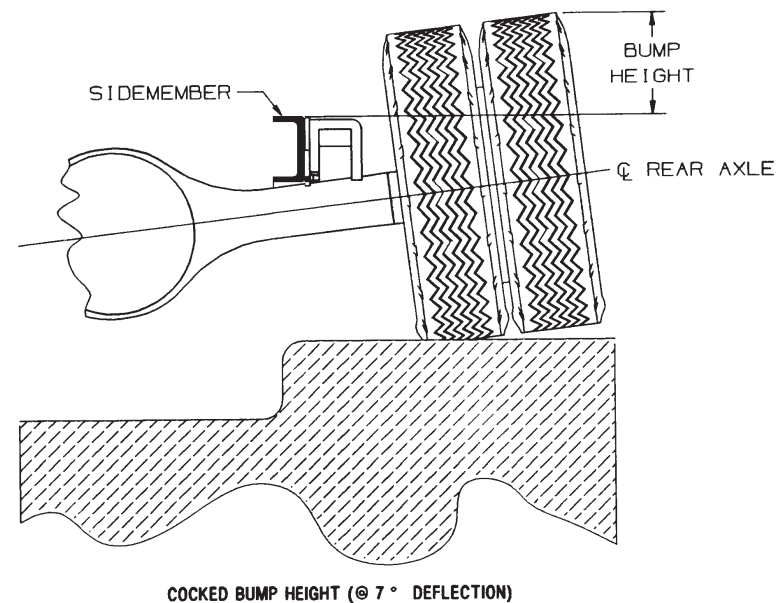
“Bump Height” refers to the maximum distance of the tires above the side rails as the rear axle of the bus travels over an object. Bump Heights are important in the selection of bus bodies since it may be necessary to incorporate wheelwells into the body floor to allow adequate clearance for tire travel.

**Straight Bump Height** is used when both sets of wheels travel over an object at the same time, such as a parking lot speed bump.



01\_0047

**Cocked Bump Height** refers to the condition that exists when only one set of rear wheels travels over an object — an example of this would be climbing over a curb when turning a corner. The Cocked Bump Height Charts presented here assume a 7° deflection from horizontal.



01\_0048

- $D_r''$  = Wheel Axis to bottom of frame in straight bump position. Refer to tabulated data.  
 $R_1$  = Tire radius (one-half of tire outside diameter) **not** mounted on the vehicle. To obtain tire dimensions, contact the tire manufacturer.  
 $F$  = Frame Rail Height. Refer to tabulated data.

<p>Straight Bump Height = <math>R_1 - D_r'' - F</math>  Cocked Bump Height = Straight Bump Height + 3.5 In.</p>
---

## MODEL 4x2

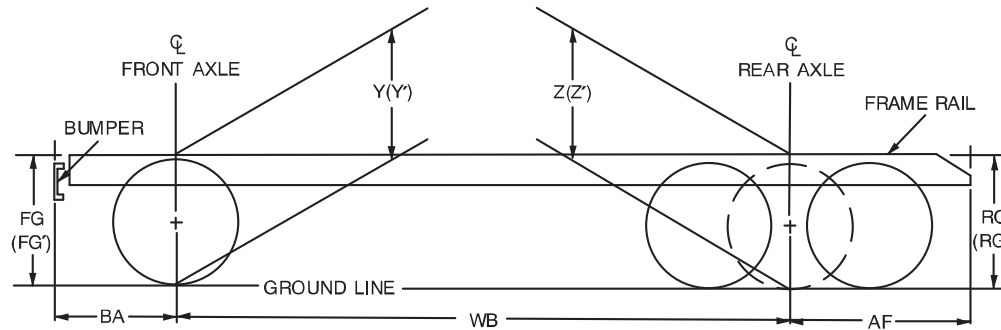
### Frame and Bump Height Data – Rear

Frame Code	Frame Rail Height (F)	Rear Suspension		Spindle to Bottom of Sidemember		
		Type	Capacity	Unloaded – D <sub>r</sub>	Loaded – D <sub>r</sub> '	Bump – D <sub>r</sub> ''
01CDN	9.125"	Vari-Rate	13,500-lb	7.95"	5.55"	3.70"
		IROS	12,000-lb	8.00"	8.00"	3.00"

## MODEL 4x2

### At Front and Rear Rail Ends

Now that we have learned to calculate the frame height at both the front and rear axle centerlines, we can determine the frame height values at both rail ends.



01\_0049

First we must determine the rake of the frame (i.e., the slope of the frame from front end to rear end). If the front end of the frame is higher than the rear end (i.e.,  $Y > Z$  or  $Y' > Z'$ ) then the truck is said to have a negative rake. In this situation, the equations for determining the frame height at the rail ends are:

Frame Height @ Front End of Rail:

$$FG = Y + \left( \frac{Y - Z}{WB} \times BA \right) \quad (\text{for unloaded condition})$$

$$FG' = Y' + \left( \frac{Y' - Z'}{WB} \times BA \right) \quad (\text{for loaded condition})$$

Frame Height @ Rear End of Rail:

$$RG = Z - \left( \frac{Y - Z}{WB} \times AF \right) \quad (\text{for unloaded condition})$$

$$RG' = Z' - \left( \frac{Y' - Z'}{WB} \times AF \right) \quad (\text{for loaded condition})$$

For situations where the rake is positive (i.e.,  $Y < Z$  or  $Y' < Z'$ ) the equations for determining frame height at the rail ends are:

Frame Height @ Front End of Rail:

$$FG = Y - \left( \frac{Z - Y}{WB} \times BA \right) \quad (\text{for unloaded condition})$$

$$FG' = Y' - \left( \frac{Z' - Y'}{WB} \times BA \right) \quad (\text{for loaded condition})$$

Frame Height @ Rear End of Rail:

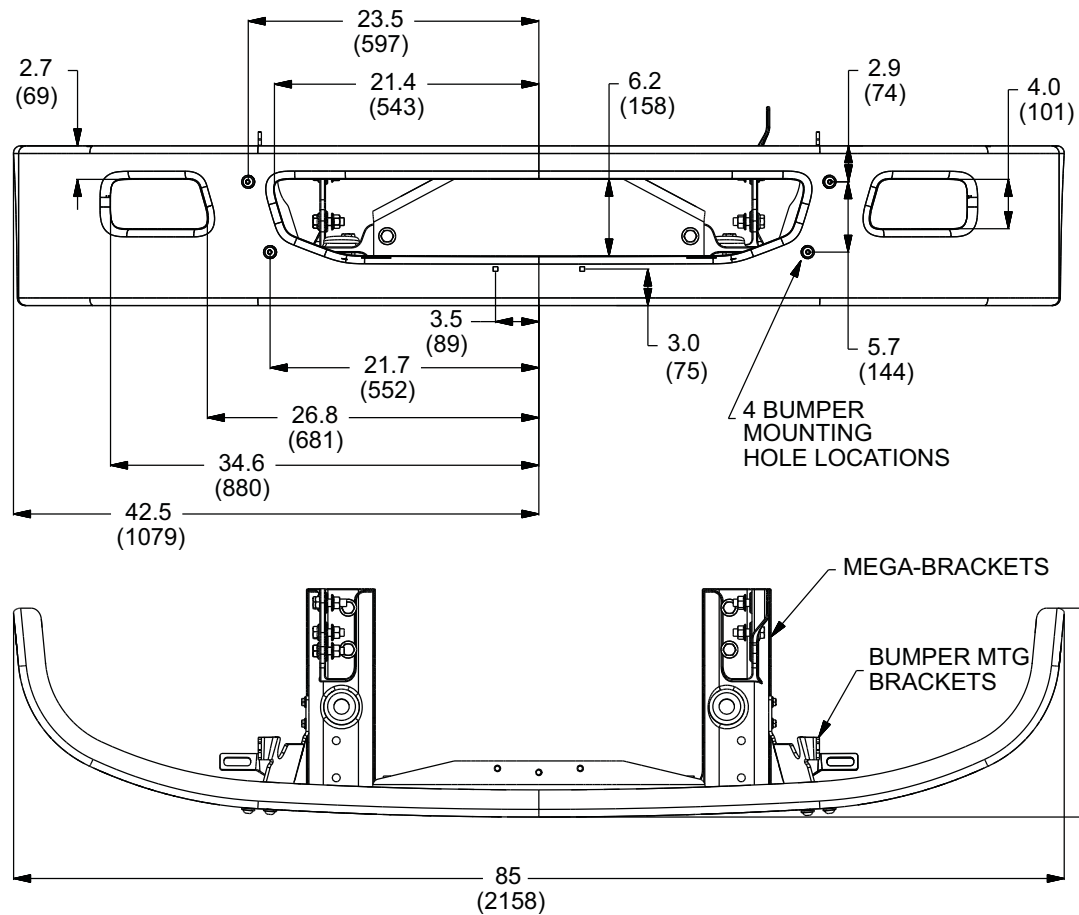
$$RG = Z + \left( \frac{Z - Y}{WB} \times AF \right) \quad (\text{for unloaded condition})$$

$$RG' = Z' + \left( \frac{Z' - Y'}{WB} \times AF \right) \quad (\text{for loaded condition})$$

## MODEL 4x2

### Bumpers

#### Standard Frame Rails and Standard Steel Bumper (01LRR)



For license plate mounting, use a tapping self-drilling hex head 1/4-14 x 5/8 screw.

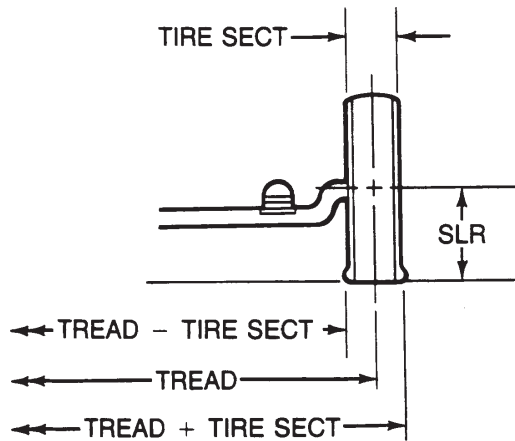
01\_0241

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## FRONT AXLES

### MODEL 4x2

#### Front Axle Tread



02\_0003

<b>TREAD</b>	= Distance (width) between vertical centerlines of single tires at opposite ends of axle, or between vertical centerlines of dual spacing (D.S.) at opposite ends of axle.
<b>TIRE SECT</b> (Tire Section)	= Overall width of new tire at top of tire under maximum load, including 24-hour inflation growth, and including protective side ribs, bars and decorations recommended by tire manufacturer.
<b>TREAD + TIRE SECT</b> (Tread plus Tire Section)	= Overall Width of axle, rim, and tire assembly at top of tires under maximum load recommended by tire manufacturer.
<b>TREAD - TIRE SECT</b> (Tread minus Tire Section)	= Distance (width) between near sides of tires at opposite ends of axle at top of tire under maximum load recommended by the tire manufacturer.
<b>SLR</b> (Static Loaded Radius)	= Distance from ground to centerline of hub when tires are correctly inflated and under maximum load recommended by tire manufacturer.

The table shown here lists tread information for various wheel/axle combinations. Tread dimensions are not dependent on tire size. Other dimensions explained here are related to tread and require tire dimensions. Please contact your tire supplier (or consult the International Sales Data Component Book (PDB-70000) for tire dimensions.

Wheel/Rim			Axle Code	
Type	Size	Material	02ADZ	02AGN
			Hydraulic Brake	
Disc	19.5 x 6.00	Steel	73.36	73.36
		Aluminum	73.80	73.80

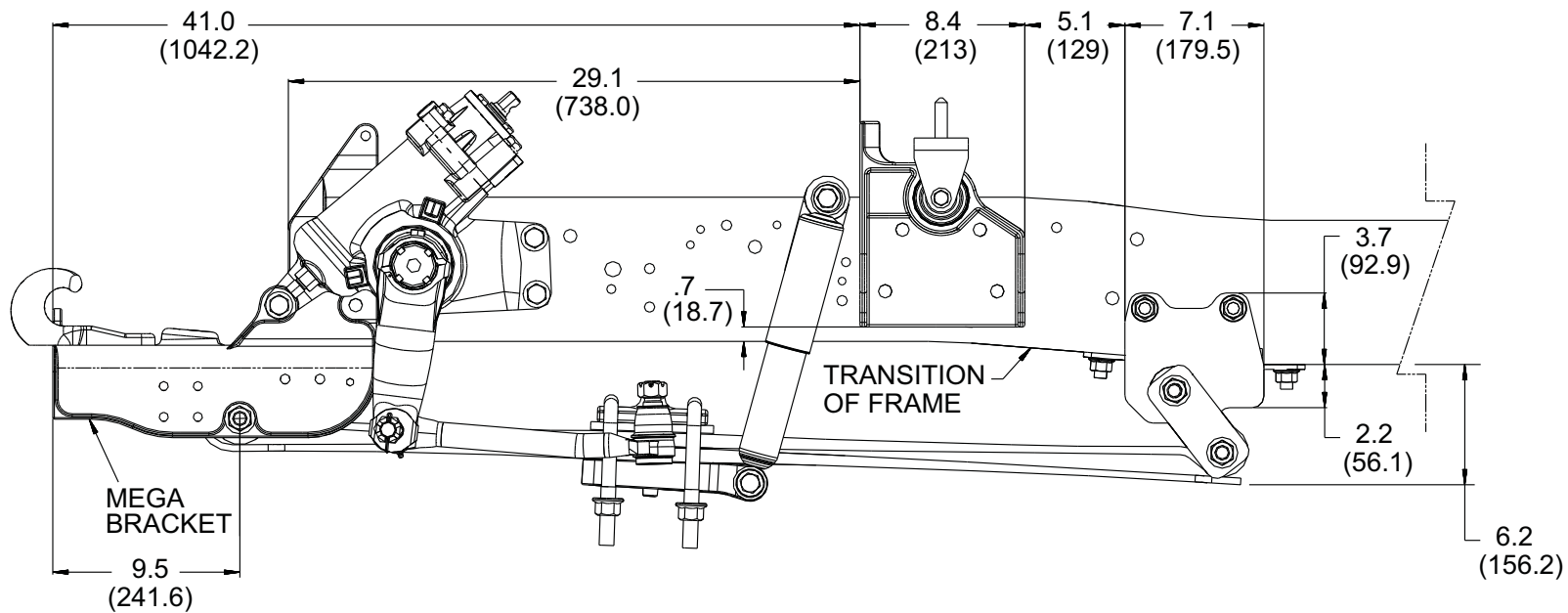
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## FRONT SUSPENSIONS

### MODEL 4x2

#### Front Suspension Brackets

- with 6,000-lb – 7,000-lb Front Suspension



03\_0026

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## BRAKES

### *MODEL 4x2*

#### Brake Restrictions

##### *Safety Measures*

Should it be necessary to modify the braking system, for example in connection with a wheelbase alteration, the following must always be observed:

- Make sure that the brake circuits are not altered. Before any part of the braking system is dismantled, mark the brake pipes and connections concerned, or make a sketch showing the original routing.
- Avoid joints, preferably change the entire brake pipe.
- Preferably, use bent brake pipes instead of elbow unions so as not to affect the brake application/release times.
- Install the brake pipes in positions where they are protected against damage and heat.
- Install the air tanks so that the drain valves still function well and are easy to reach.

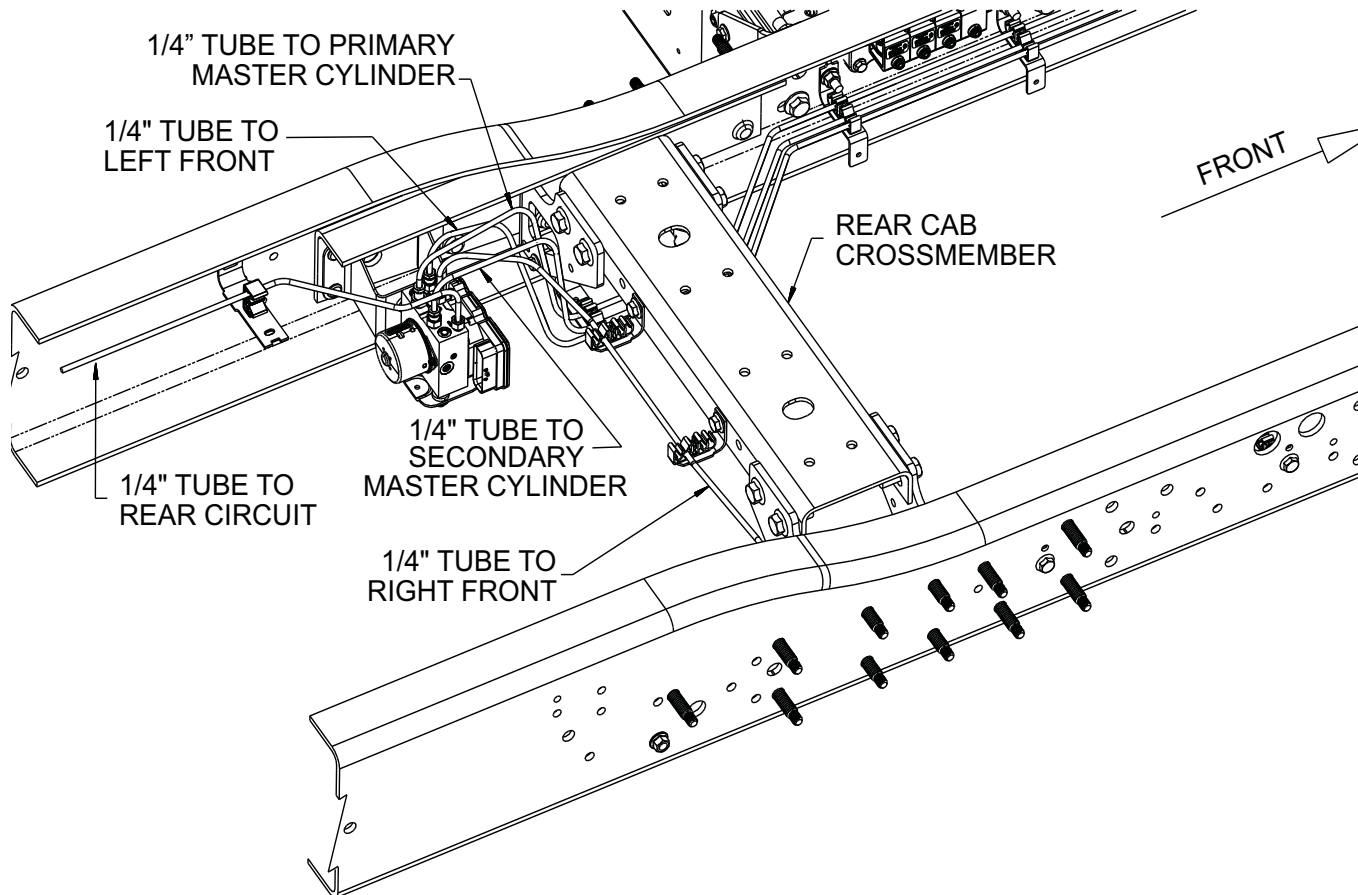
**CAUTION:** When a brake pipe is replaced or jointed, use only genuine IC Bus<sup>™</sup> parts of the correct type.

**NOTE:** On vehicles with ABS brakes, the sensor cable must not be jointed. If necessary, it must be completely replaced.

## MODEL 4x2

### Hydraulic Control Unit Plumbing

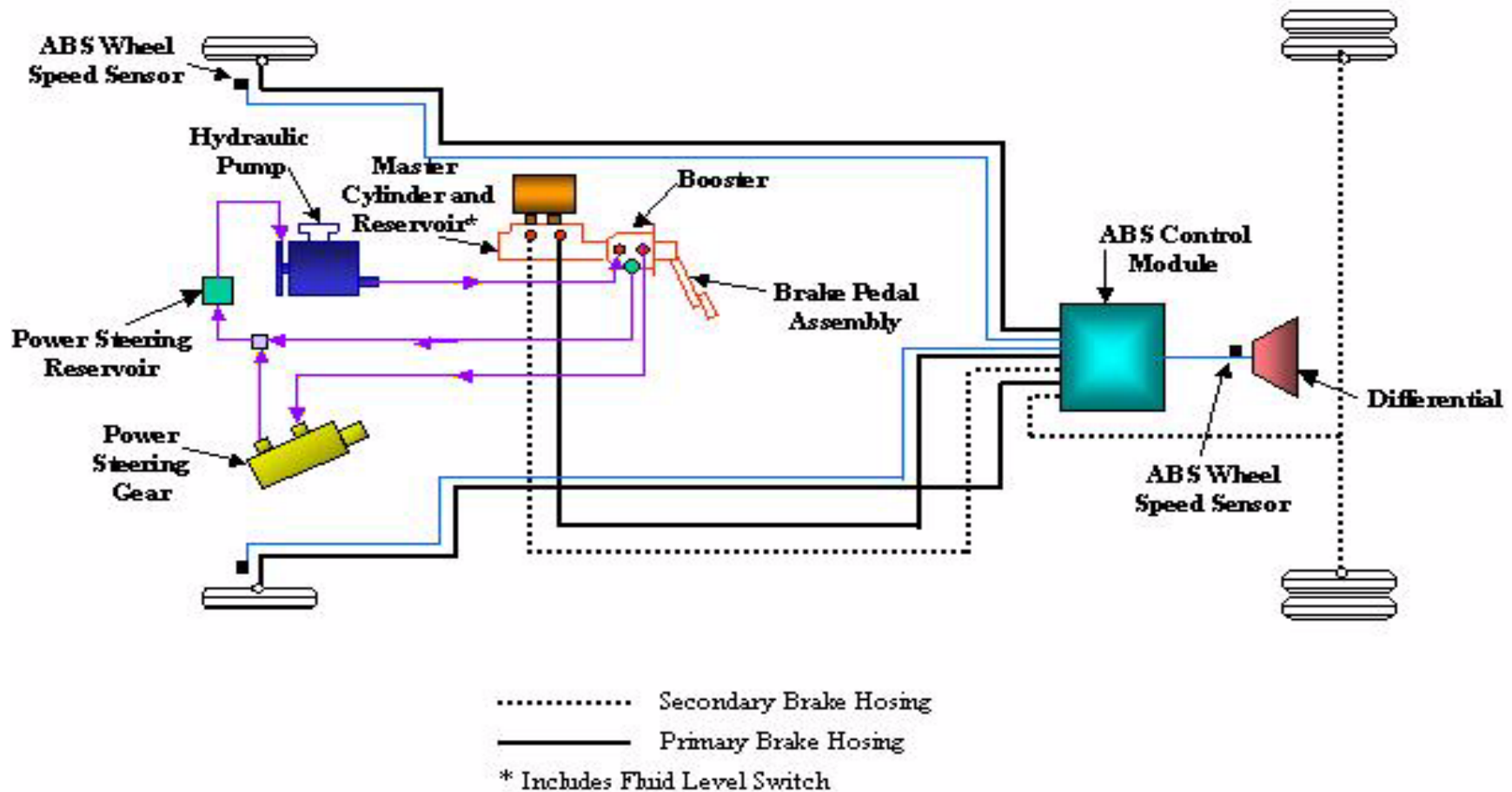
Hydraulic Control Unit Plumbing



04\_0108

## Hydraulic Brake System With 3-Channel ABS

(with Brake System Code 04087)



04\_0079

*ALL MODELS***Routing Guidelines**

If modifications are made to International vehicles with the addition or re-routing of tubing the following guidelines found in the Federal Motor Carrier Safety Regulations Pocketbook, section 393.45, should be followed:

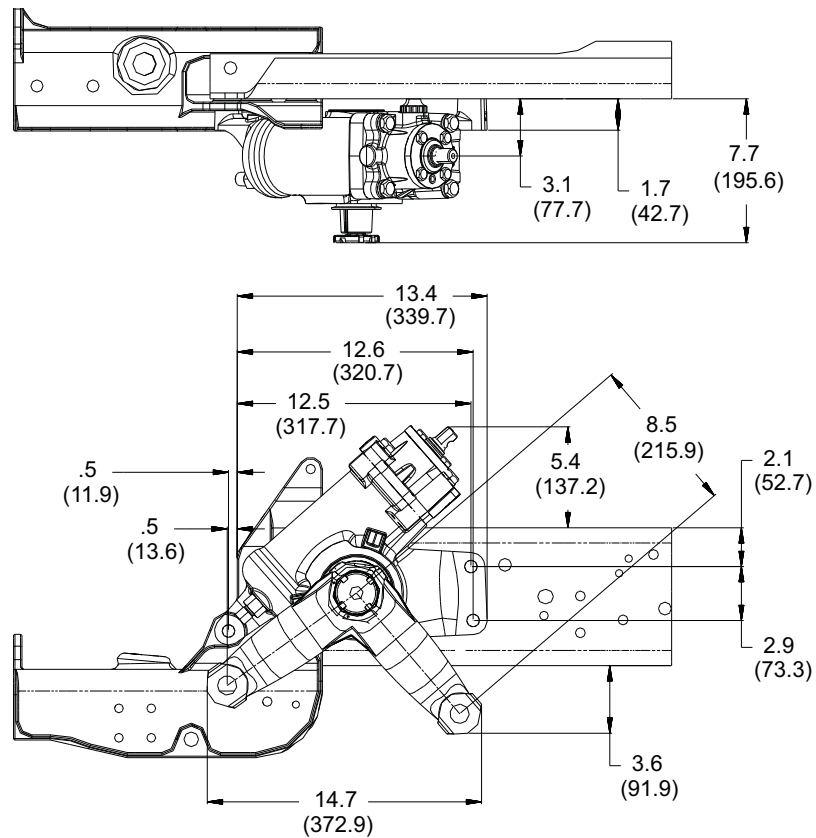
- Be designed and constructed in a manner that insures proper, adequate, and continued functioning of the tubing or hose.
- Be installed in a manner that insures proper continued functioning of the tubing or hose.
- Be long and flexible enough to accommodate without damage all normal motions of the part to which it is attached.
- Be suitably secured against chafing, kinking, or other mechanical damage.
- Be installed in a manner that prevents it from contacting the vehicle's exhaust system or any other source of high temperatures.

## STEERING

### MODEL 4x2

#### Steering Gear Location/Dimensions

Code 05PSN



05\_0039

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## EXHAUST SYSTEM

### GUIDELINES FOR AFTERTREATMENT MODIFICATIONS

Navistar, Inc. has a responsibility to supply, install and ensure that the engines and aftertreatment emission control devices comply with the certification requirements of the U.S. Environmental Protection Agency (EPA) and the California Air Resources Board (ARB). The aftertreatment devices may include a combination of particulate filters, catalysts, catalytic converter, and temperature and pressure sensors, along with other components.

Proper long-term operation of these components requires controlling exhaust stream temperatures and the exhaust flow pattern throughout the system. This controls the required location of the components as well as the insulation of the various parts of the system.

For this reason, application guidelines for aftertreatment and tailpipe installations are much more complex and restrictive than in the past. Navistar, Inc. will ensure correct factory installation of aftertreatment devices to assure compliance with the certification requirements.

Modified systems could damage the engine, aftertreatment system and other truck systems and void the warranty coverage. In that regard, Navistar, Inc. will make it a policy to procure and correctly install the appropriate aftertreatment devices pursuant to applicable specifications and application guidelines. That brings with it the benefit of certified systems that will be fully covered under warranty provided the vehicle is properly maintained and not modified beyond the extent allowed by the Body Builder book.

The following guidelines are meant to clarify the allowable modifications for aftertreatment systems. Please consult applicable federal, state and local laws and requirements in conjunction with this document to ensure compliance to those requirements. Also, refer to applicable vehicle warranty information before performing any modifications to the vehicle. Non-compliance to the requirements of the warranty may nullify it in its entirety.

- Where possible, buses first and foremost should be ordered directly from the factory that meets the body installation requirements so that the minimum, or no modification of the exhaust system will be required.
- Where this is not possible, if another exhaust configuration is available from the factory that closer meets the need of the body installation, it is permissible to completely replace one exhaust configuration with the better choice exhaust system provided that would have been available with the same engine, and the clearance guidelines in this reference are followed.
- Exhaust Gas Temperatures may be as high as 800× C during vehicle operation. Precautions should be taken to ensure that materials used in the vicinity of the exhaust system and exhaust gas stream can withstand these temperatures or are safely shielded.

#### Meeting Legal Requirements

**It is the responsibility of the person performing modifications to the vehicle to ensure that the vehicle, in its final configuration, conforms to any applicable law regarding emission control, noise level and applicable safety standards.**

#### TURBO PIPE

*The function of the Turbo Pipe is to deliver exhaust gases from the engine to the Aftertreatment Module so that temperature losses are minimized and so that the flow pattern of the exhaust gases maximizes the efficiency of the Aftertreatment Module. Any modifications to this piping without written approval of Navistar, Inc. may significantly reduce the performance of the Aftertreatment Module and VOID any applicable warranty.*

All Modifications to Turbo Pipe Location, Geometry and Materials MUST be approved by Navistar, Inc.

If so equipped, heat shields and protective wraps must be maintained on the vehicle to ensure the proper performance of the Aftertreatment Module and for the protection of the installed truck systems.

Never mount any additional harnesses or other equipment to the Aftertreatment Module.

#### AFTERTREATMENT MODULE

*The function of the Aftertreatment Module is to catch soot exhausted from the engine and convert it to ash. It is critical that the temperature and pressure sensors' wiring remain intact for the Aftertreatment Module to perform as designed. It is critical to maintain the location of the Aftertreatment Module as installed from the factory to ensure its proper operation. Any modifications to the Aftertreatment Module without the written approval of Navistar, Inc. may significantly reduce the performance of the Aftertreatment Module and VOID any applicable warranty.*

All Modifications to Aftertreatment Module Location, Geometry, Materials, Wiring, Sensors or Tubing MUST be approved by Navistar, Inc..

If so equipped, heat shields and protective wraps must be maintained on the vehicle to ensure the proper performance of the Aftertreatment Module and for the protection of the installed truck systems.

Never mount any additional harnesses or other equipment to the Aftertreatment Module.

#### TEMPERATURE CONTROL DEVICE

*The function of the Temperature Control Device (if so equipped) is to reduce the exit exhaust gas temperature emitted from the Aftertreatment Device. This device has been specifically designed to draw in cooler air to mix with the hotter exhaust gases. It is critical that the openings in the device that draw in cooler air remain unblocked of debris or other equipment. This device is critical to ensure that the emitted temperatures of the exhaust are minimized. Any modifications to the Temperature Control Device without the written approval of Navistar, Inc. may significantly reduce the efficiency of the Temperature Control Device and significantly increase the emitted gas temperatures, and VOID any applicable warranty.*

If so equipped, any installed Temperature Control Device MUST remain as part of the exhaust piping.

Changes to the location of the Temperature Control Device relative to the Aftertreatment Module must meet federal emissions, noise and safety requirements. The responsibility for demonstrating that legal requirements are met when modifications have been made belongs to the modifier of the system.

If changing the location, special attention must be given to maintaining clearances around the exhaust piping, as well as maintaining the structural integrity and exhaust backpressure of the system. Tables included in this document provide recommended clearances and back pressure estimation procedures.

#### EXHAUST PIPING MODIFICATIONS

Never modify the internal structure of the Turbo Pipe, the Aftertreatment Module or the Temperature Control Device.

When lengthening or shortening tailpipes beyond the Aftertreatment Module, observe the following precautions:

1. Use the same size and material to extend or shorten the original pipe.
  - *Refer to Table 3.1 for proper material and sizing of pipes when extending or shortening tailpipe sections.*
2. Adding additional extensions and bends will change internal exhaust gas pressure, which could result in damage to the Aftertreatment Module or other engine components as well as a reduction in fuel economy.
  - *Use the worksheets provided to compute the change in backpressure of the modified exhaust piping. Ensure that the limits within the worksheet are met to avoid performance issues and to maintain warranty of the engine and aftertreatment system.*
3. Support additional piping using rubber mounts approved by International Truck and Engine Corporation (P/N 3533072C1 Isolator and P/N 3561980C1 Metal Sleeve). Add one additional support for every 4 linear feet of exhaust piping added, evenly spaced along the length of the chassis.

The exhaust piping should be routed so that the Temperature Control Device, if so equipped, is at the end of the exhaust pipe and oriented in the same manner as received from the factory.

Route all piping with minimum clearances to other chassis components as shown in Table 3.2.

#### MOUNTING OF BODY EQUIPMENT

In comparison to vehicles produced prior to 2007, exhaust components surface temperatures and exhaust gas temperatures will typically be higher.

As a result of the increased temperatures, clearances to exhaust components will need to be increased compared to pre-2007 model year clearances.

Typical installation clearances used for pre-2007 model year engines and exhaust systems should be increased by 40% to ensure that body equipment is not damaged by the increased heat of these systems.

Do not mount any Body Equipment within 8 inches (200mm) of the exhaust pipe outlet to avoid damage from hot exhaust gases.

When modifying other chassis systems, maintain clearances shown in Table 3.2.

TABLE 3.1 – TAILPIPE EXTENSION, MATERIAL AND PIPE SIZING

MaxxForce® 7	
Pipe Material	409 Stainless Steel
Pipe Diameter	4"
Wall Thickness	0.065"

TABLE 3.2 – MINIMUM CLEARANCES BETWEEN EXHAUST SYSTEM COMPONENTS AND OTHER CHASSIS COMPONENTS

Component	Minimum Clearance, in (mm)
Electric Harness	6.0 (150)
Electric Harness (w. heat guard)	4.0 (100)
Mechanical Cable	2.0 (50)
Fuel Tube, metal	6.0 (150)
Fuel Tube, rubber or plastic	6.0 (150)
Brake Tube, metal	4.0 (100)
Brake Tube, rubber or plastic	4.0 (100)
Tire	4.0 (100)
Fuel Tank	4.0 (100)

## Allowable backpressure tailpipe modification worksheet

Engine:

MaxxForce® 7

Exhaust Configuration:

Horizontal - Horizontal

a	Qty of 90× elbows added	_____	x	0.11 =	_____
b	Qty of 60× elbows added	_____	x	0.09 =	_____
c	Qty of 45× elbows added	_____	x	0.08 =	_____
d	Qty of 30× elbows added	_____	x	0.06 =	_____
e	Feet of straight pipe added	_____	x	0.02 =	_____
f	Temperature Control Device Pressure				0.70
g	Pipe Exit Pressure				0.31

Total Modification Backpressure (Add a-g)

Allowable Backpressure Limit

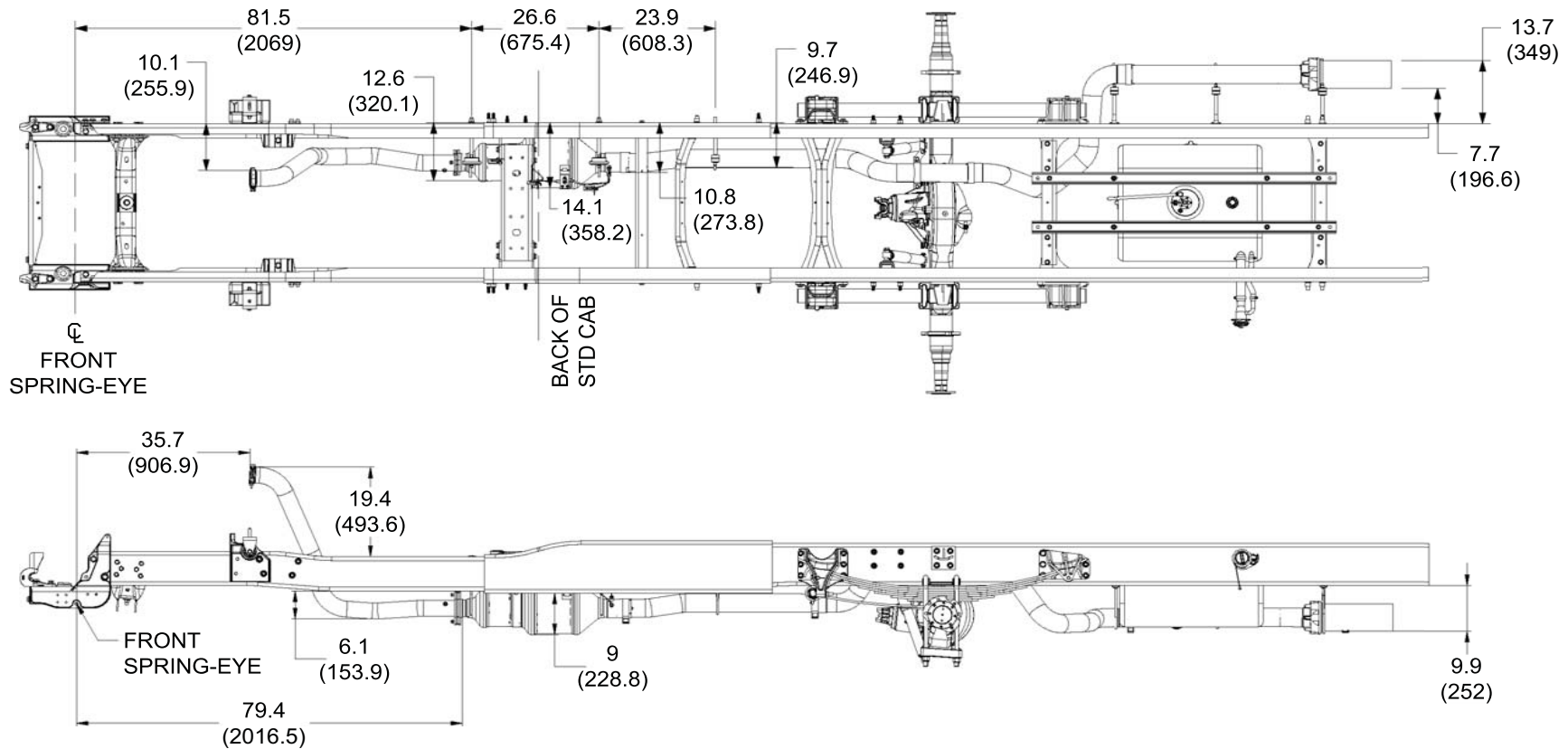
3.3

Is allowable Backpressure Limit **GREATER** than Total Modification Backpressure?If **YES**, Modifications **MEET** Engine Manufacturer's Guidelines and **CAN** be performed.If **NO**, Modifications will **NOT MEET** Engine Manufacturer's Guidelines and **CANNOT** be performed.

## MODEL 4x2

### Horizontal Aftertreatment

Code 07BDV – Right Side Mounted



UC\_07bdv\_right\_side\_mount

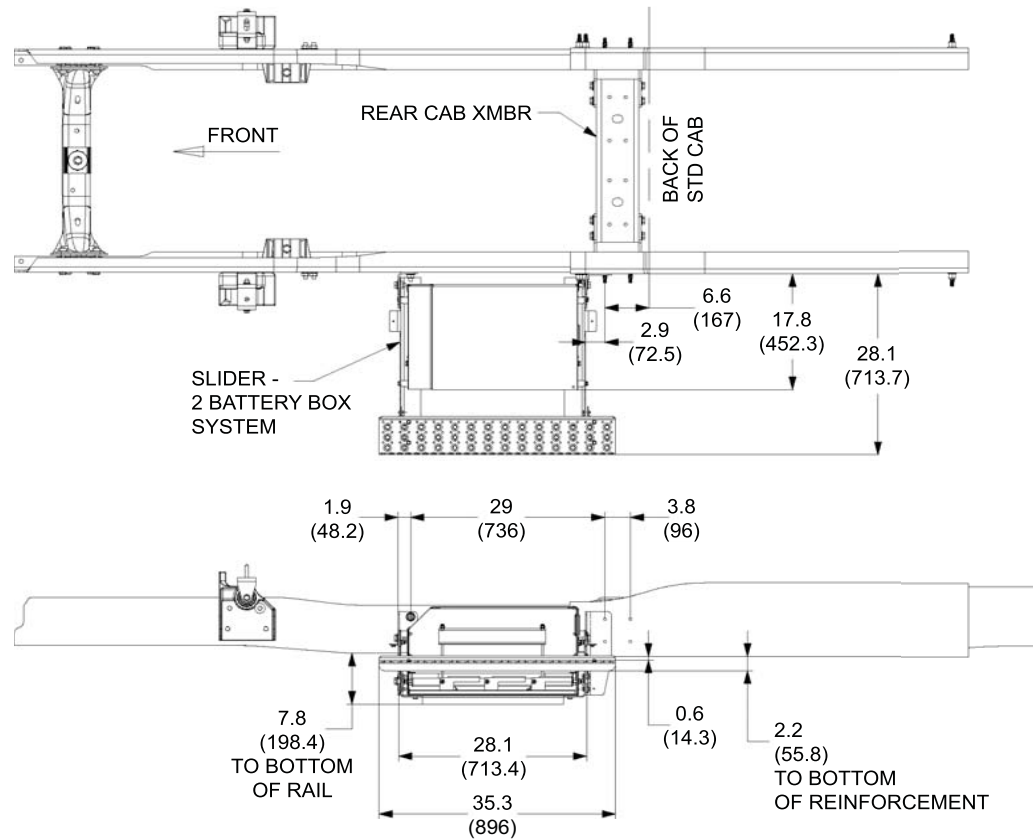
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## ELECTRICAL

### MODEL 4x2

#### Battery Box Location

Left Side Mounted, Under Cab, 2 Batteries

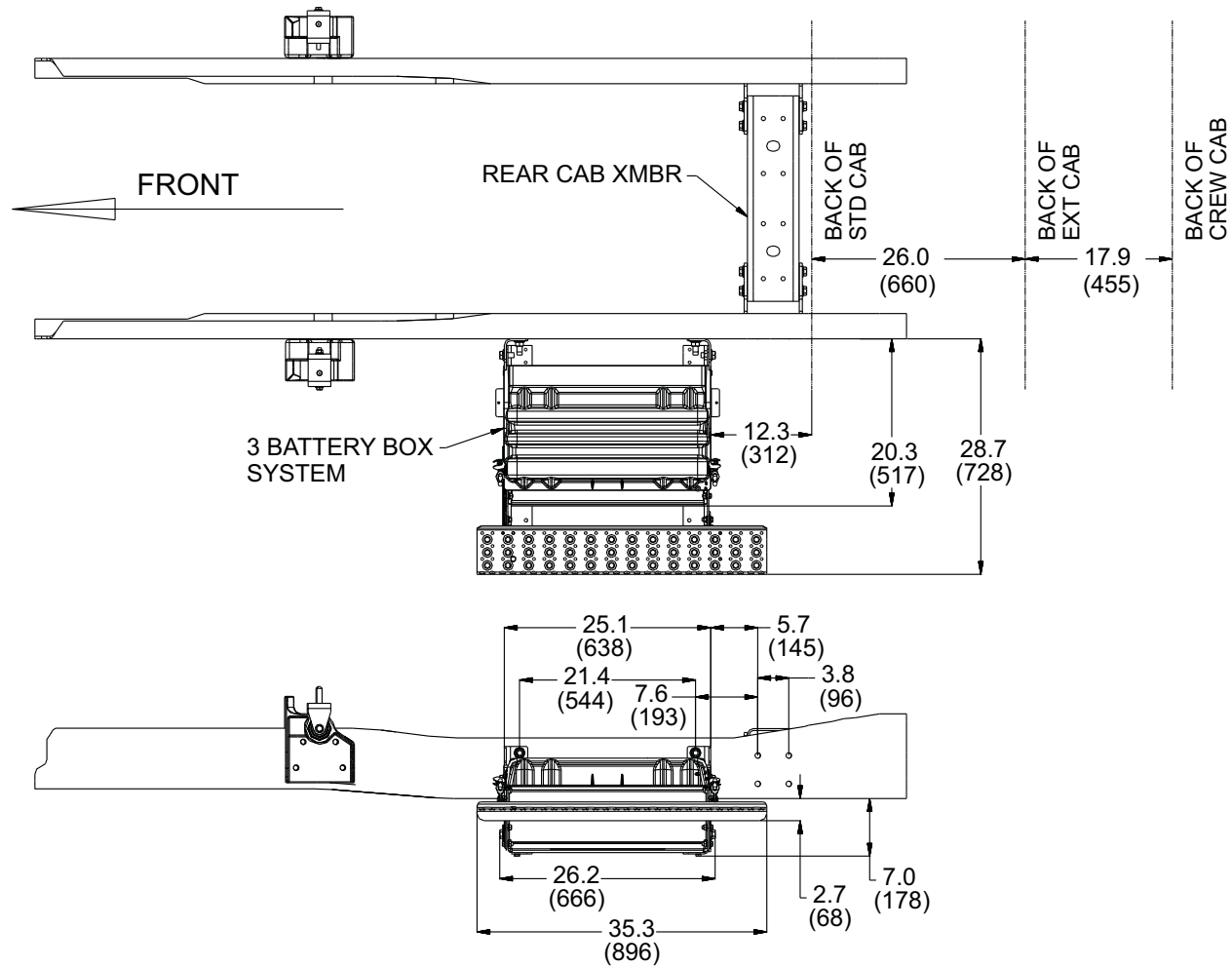


UC\_slider\_2\_battery\_box

## MODEL 4x2

### Battery Box Location (Continued)

Left Side Mounted, Under Cab, 3 Batteries



08\_0134

## MODEL 4x2

### Electrical System - Allison Automatic Transmission

#### 1000/2000 Series

Body builder Input/Output connection for Allison 1000/2000 transmissions is located on the front dash panel, in the engine compartment, on the drivers' side. The table below gives the circuit and connector cavity information. For a complete circuit diagram of the transmission wiring and for connector & terminal part numbers, see vehicle circuit diagram book.

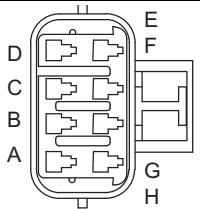
Cavity	Circuit Number	I/O	Maximum Current	Description
Connector Number 7205				
A	92C103	–	–	Signal Ground
B	92#143	Input	–	PTO Enable
C	92#150	Output	500 mAmp	PTO Enable 2
D	47C125	Output	–	Non-Zero Crossing Speedo (16 Pulses/Rev)
E	92#101	Input	–	Auxiliary Function Range Inhibit
F	92#123	Input	–	Auto Neutral for PTO
G	92#145	Output	500 mAmp	Range Indicator
H	92#105	Output		Output Speed Indicator

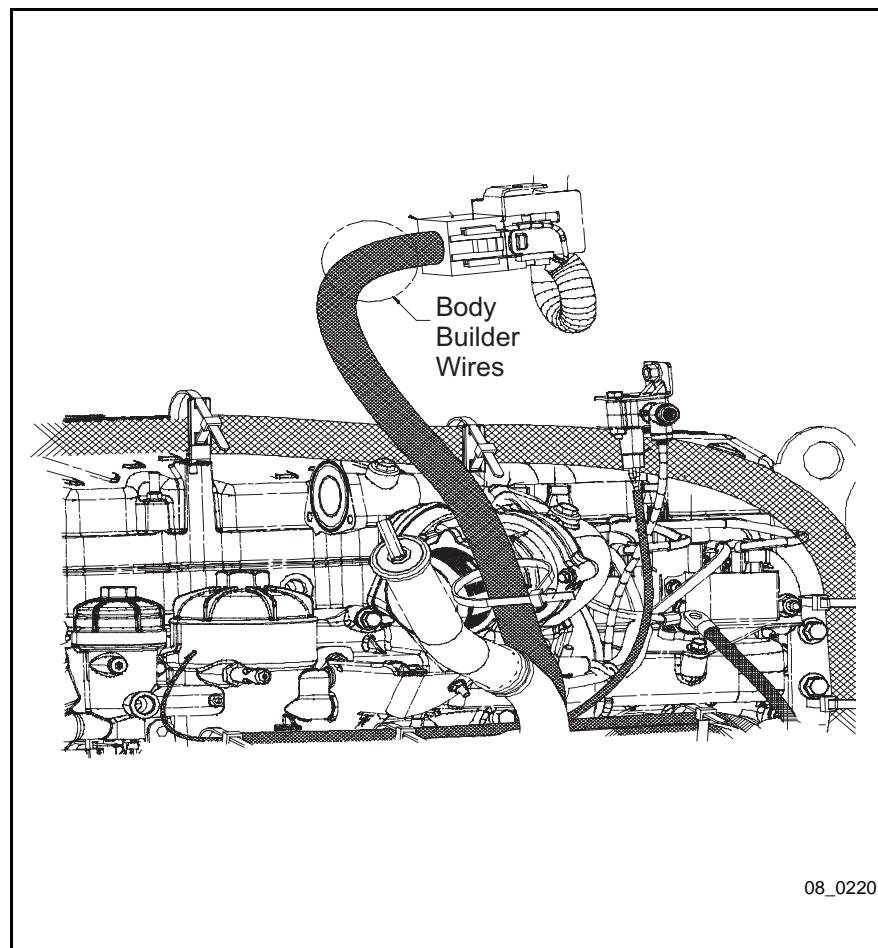
**NOTE 1:** See Allison technical manual for suggested circuit design.

**NOTE 2:** See special features table on next page for package content.

**NOTE 3: MUST COMPLY WITH FMVSS STANDARD #102.**

Connector 7205 has its mating connector attached and filled with cavity plugs. To use connector, remove cavity plugs and use the following:

Harness Connectors (Viewed from Mating End)		Mating Connector	
	08_0021	Connector 352874C1	Connector Lock 352875C1
		Terminals 1667742C1	Wire Gauge 16, 18, 20
		Cable Seal 1661872C1	



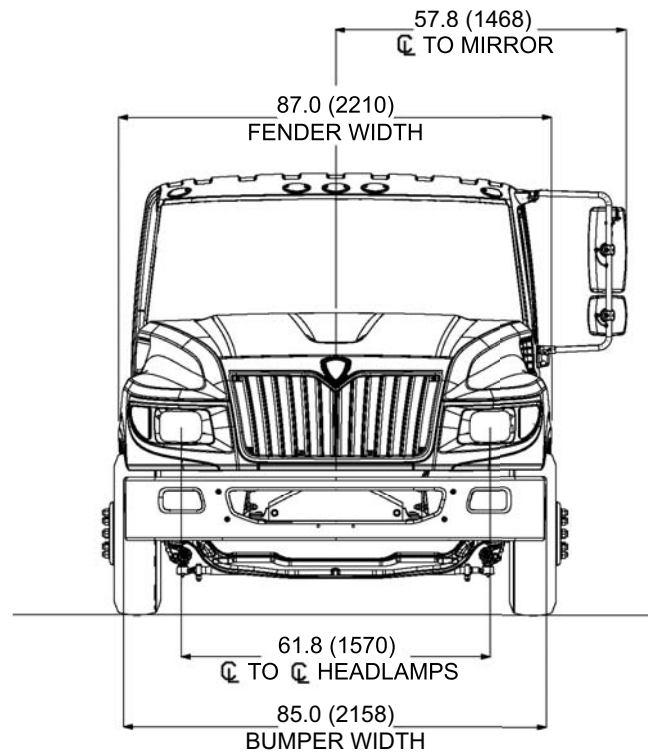
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## ENGINE

### *MODEL 4x2*

#### Cooling Obstruction Guidelines

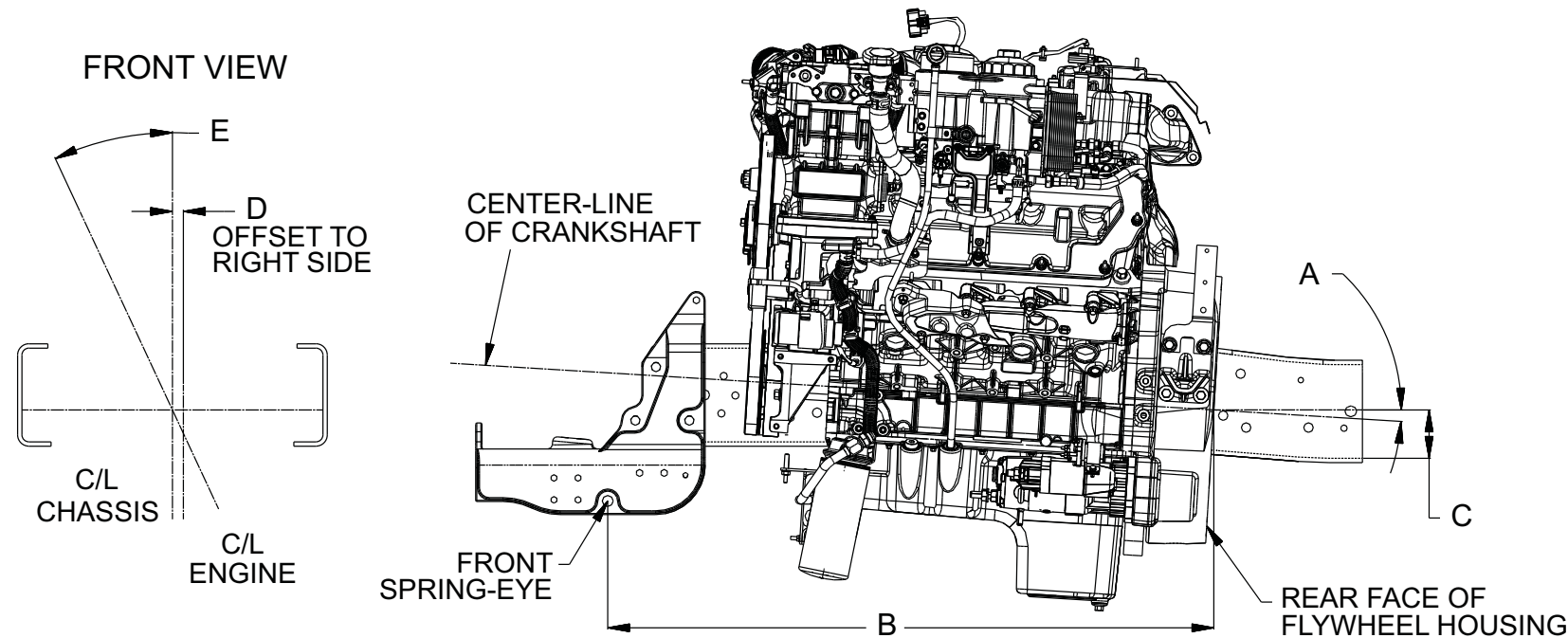


NOTE: DO NOT OBSTRUCT AIR FLOW IN FRONT OF GRILLE OR BELOW BUMPER

UC\_front\_view

MODEL 4x2

Engine Location



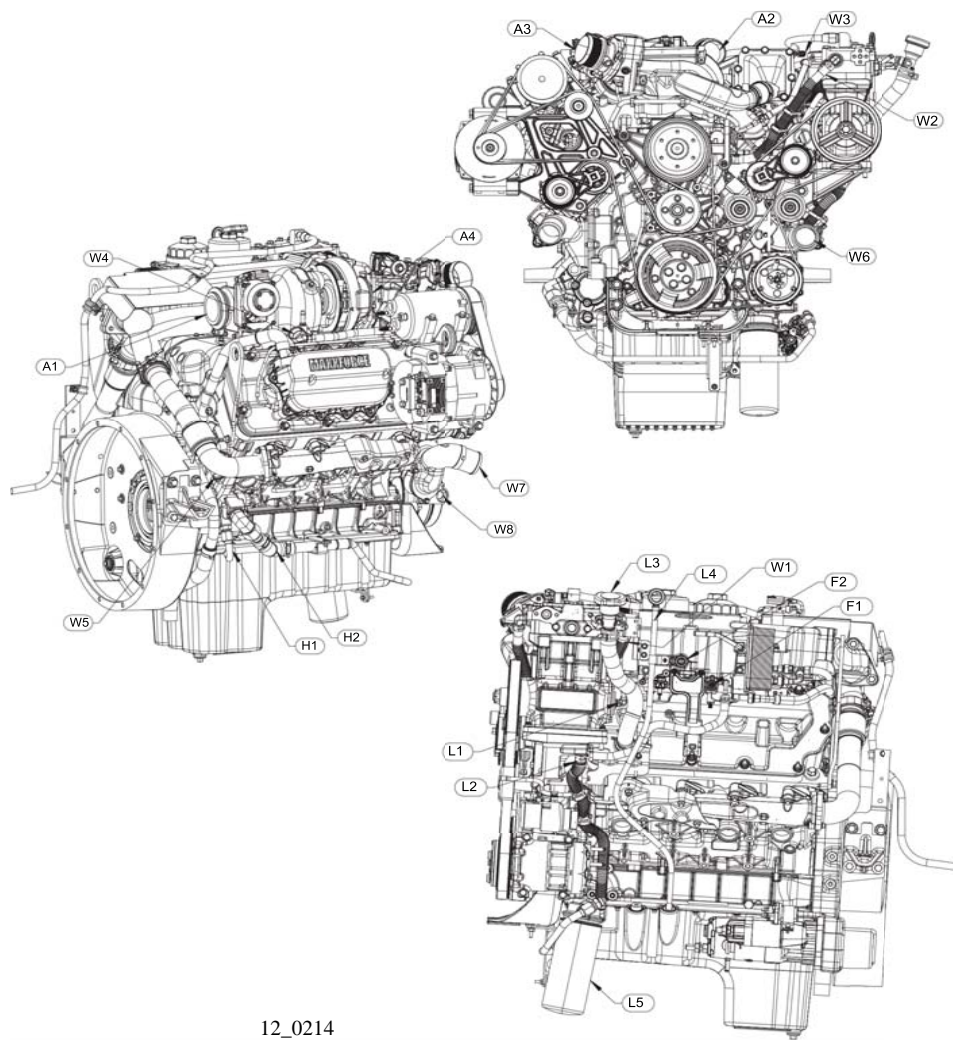
12\_0213

Engine	A	B	C	D	E
International® MaxxForce® 7	3.5°	43.7" (1109.3 mm)	3.5" (88.4 mm)	0°	0°

## MODEL 4x2

### Engine Port Location

International® MaxxForce® 7



12\_0214

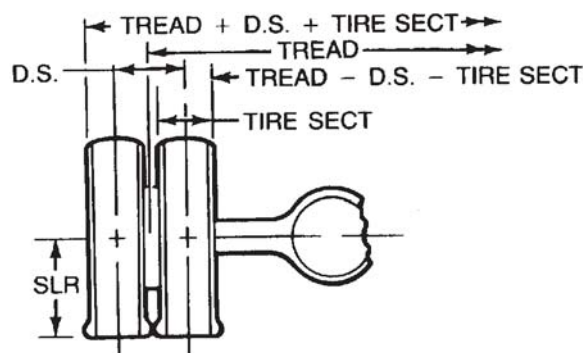
Type	NPTF	Usage
<b>Water</b>		
W1	M18	Air Compressor Water Supply
W2	M18	Air Compressor Water Return
W3	M18	Deaeration Supply
W4	M18	Heater Supply
W5	—	Block Heater
W6	—	Engine Water Inlet
W7	—	Engine Water Outlet
W8	—	Heater Return
<b>Air</b>		
A1	—	Turbo Outlet Exhaust
A2	—	Turbo Air Outlet to Inter-Cooler
A3	—	Engine Air Inlet from Inter-Cooler
A4	—	Engine Air Inlet from Air Cleaner
<b>Oil</b>		
L1	M14	Supply Air Compressor
L2	M18	Return Air Compressor
L3	—	Engine Oil Fill
L4	—	Oil Level Gauge
L5	—	Oil Filter
<b>Fuel</b>		
F1	—	Fuel Supply
F2	—	Fuel Return
<b>Hydraulic</b>		
H1	7/8"– 14	Power Steering Hydraulic Line
H2	—	Power Steering Pump Supply Line

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## REAR AXLES & REAR SUSPENSIONS

### MODEL 4x2

#### Rear Axle Tread



<b>TREAD</b>	= Distance (width) between vertical centerlines of single tires at opposite ends of axle, or between vertical centerlines of dual spacing (D.S.) at opposite ends of axle.
<b>TIRE SECT</b> (Tire Section)	= Overall width of new tire at top of tire under maximum load, including 24-hour inflation growth, and including protective side ribs, bars and decorations recommended by tire manufacturer.
<b>D.S.</b> (Dual Spacing)	= Dimension (width) between vertical centerlines of two tires (duals) assembled at one end of an axle.
<b>TREAD + D.S. + TIRE SECT</b> (Tread plus Dual Spacing plus Tire Section)	= Overall width of axle, dual rims, and tire assembly at top of tires under load.
<b>TREAD - D.S. - TIRE SECT</b> (Tread minus Dual Spacing minus Tire Section)	= Distance (width) between near sides of inner tires of dual assembly at top of tires under load.
<b>SLR</b> (Static Loaded Radius)	= Distance from ground to centerline of hub when tires are correctly inflated and under maximum load recommended by tire manufacturer.

#### Dual Tires

14\_0005

The table shown here list tread information for various wheel/axle combinations. Tread dimensions are not dependent on tire size. Other dimensions explained here are related to tread and require tire dimensions. Please contact your tire supplier or consult the International Sales Data Component Book (PDB-70000) for tire dimensions.

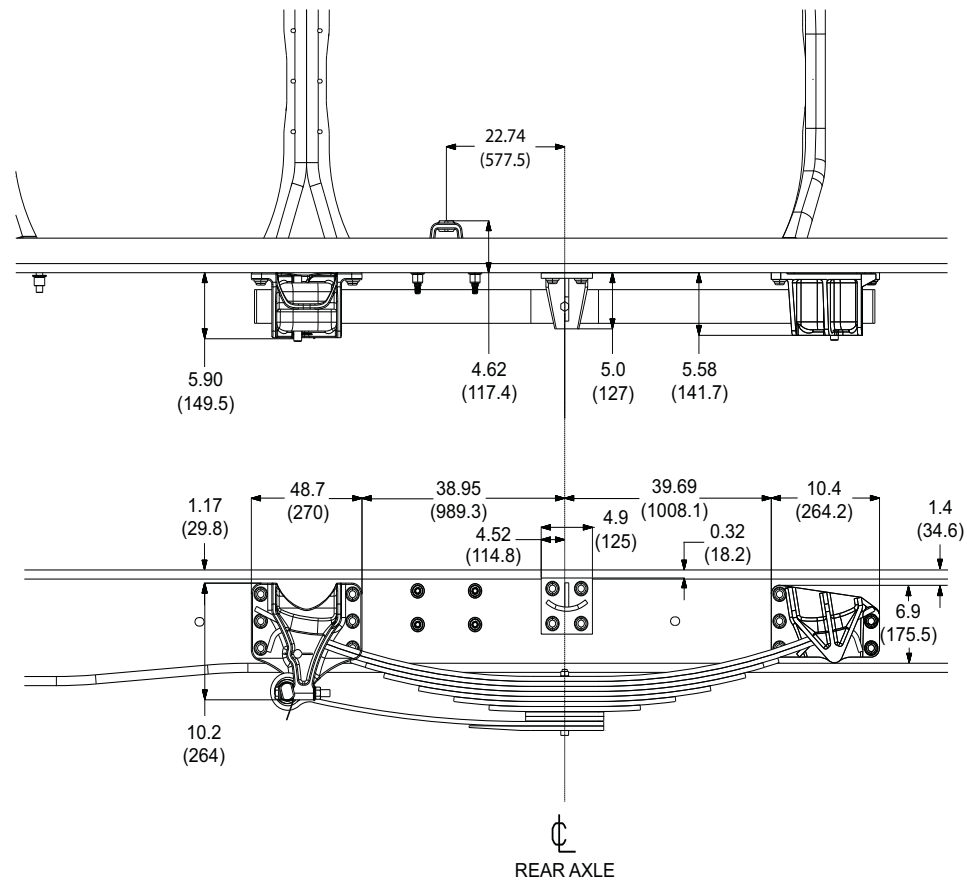
Wheel/Rim				Axle Code 14ACN
Type	Size	Material	Dual Spacing	Hydraulic Brake
Disc	19.5 x 6.00	Steel	10.70	74.0
		Aluminum		

## MODEL 4x2

### Rear Suspension Bracket Location

Code 14SAC

Vari-Rate Steel Suspension



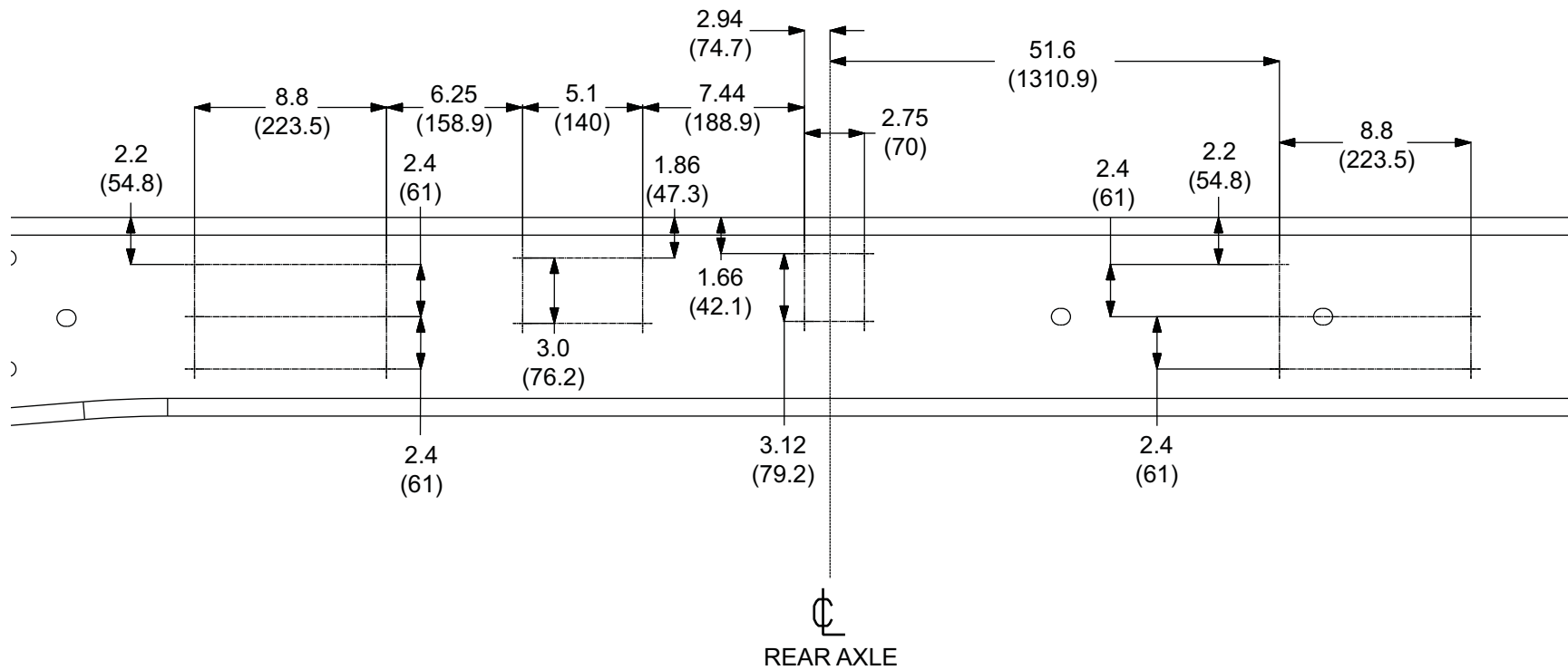
UC\_vari-rate\_14sac\_bracket\_location

## MODEL 4x2

### Rear Suspension Drilling

Code 14SAC

Vari-Rate Steel Suspension



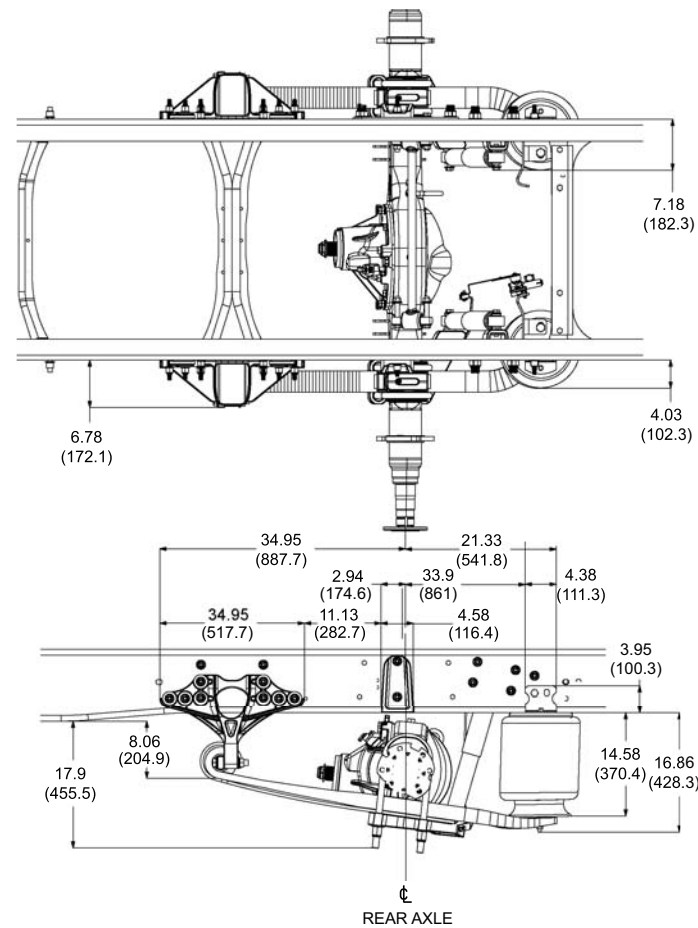
UC\_vari-rate\_14sac\_suspension\_drilling

## MODEL 4x2

### Rear Suspension Bracket Location

Code 14TCP

International® Ride Optimized Air Suspension, 8.0" Ride Height



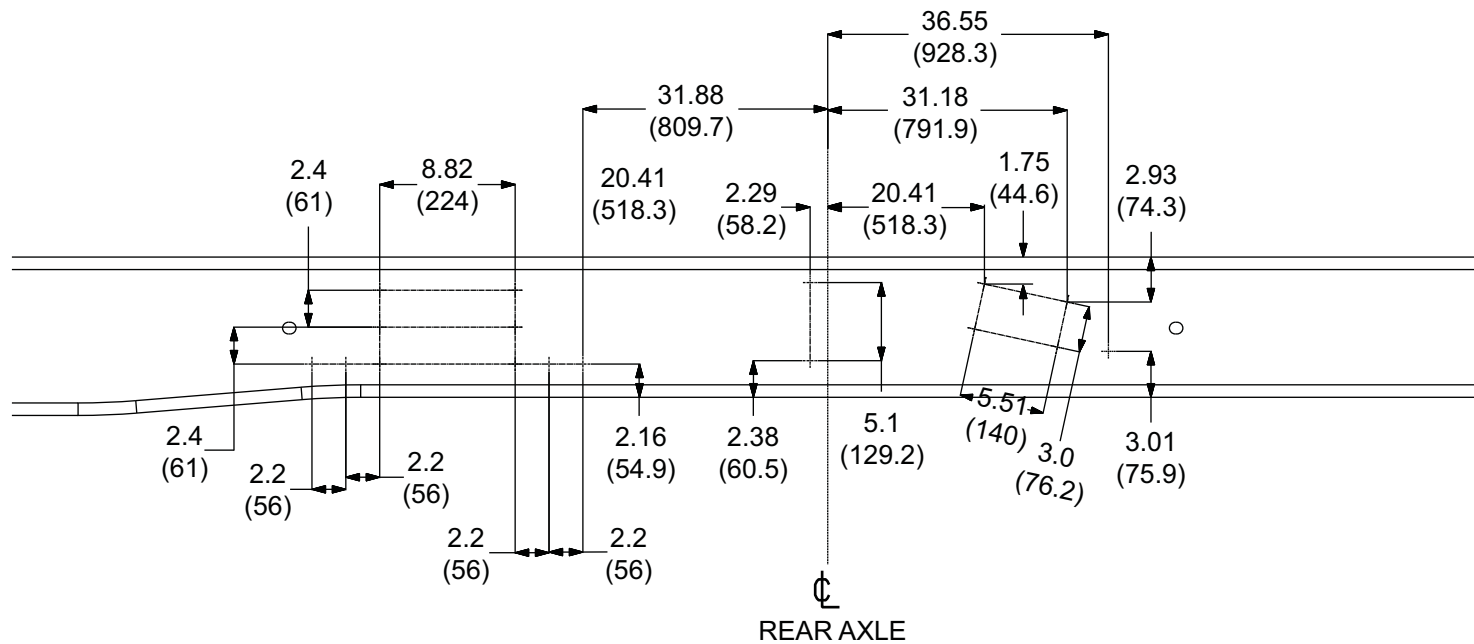
UC\_iros\_14tcp\_bracket\_location

## MODEL 4x2

### Rear Suspension Drilling

Code 14TCP

International® Ride Optimized Air Suspension, 8.0" Ride Height



UC\_iros\_14tcp\_suspension\_drilling

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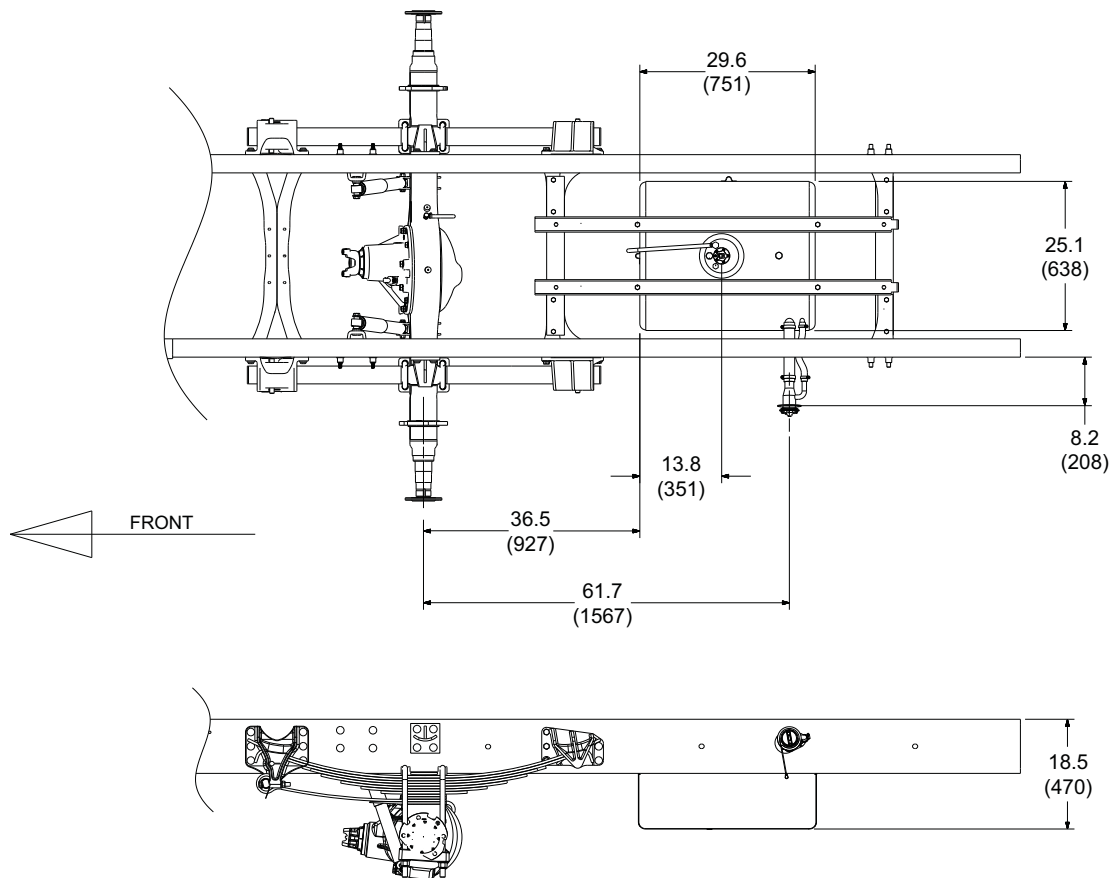
## FUEL TANKS

### MODEL 4x2

#### Fuel Tank Location

Code 15SSW

Single Mounted Between Rails Behind Rear Axle, 40 Gallon, with Fuel Fill Tube



UC\_40\_gallon\_btr\_fuel\_tank

Per EPA Title 40, Part 86, 86:007-35(c), the decal shown below must be installed on the vehicle.

Decal is included with Owner's Guide Kit located in the cab glove box.



15\_0005

#### INSTRUCTIONS FOR DECAL PLACEMENT:

1. The decal must be placed as close as possible to the fuel inlet and be **clearly visible**.
2. The decal should be placed above or to the side of the fuel cap to avoid corrosion by possible contact with fuel.
3. The decal may be placed on aerodynamic fairings, bodies, etc. as long as the decal is clearly visible and in close proximity to the fuel inlet.
4. For installed bodies that have a fuel door (e.g. buses), the decal should be placed above or to the side of the fuel door.

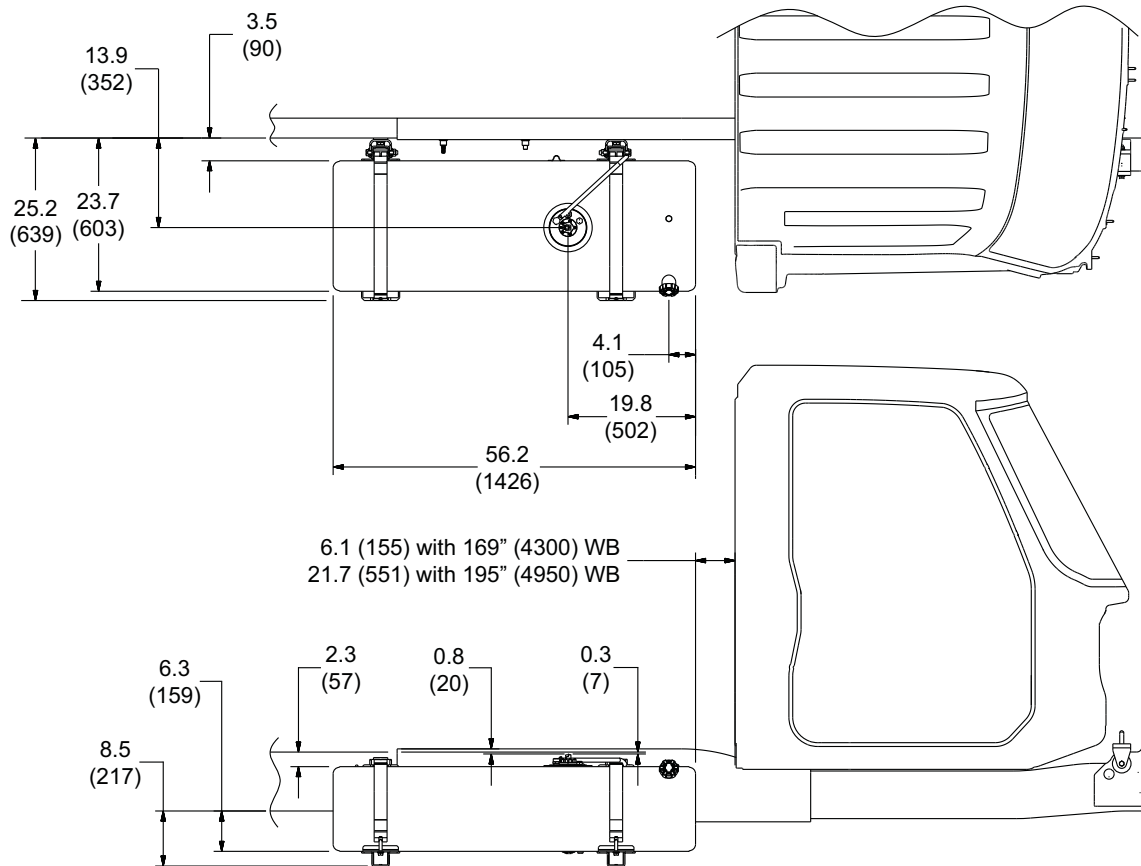
Thoroughly clean the area of all grease, dirt, etc. before application of the decal. Apply the decal at room temperature, 65° to 75° F.

## MODEL 4x2

### Fuel Tank Location (Continued)

Code 15STD

Single Mounted Between Rails Behind Rear Axle, 55 Gallon, with Fuel Fill Tube



UC\_fuel\_tank\_rsm\_4300\_4950

Per EPA Title 40, Part 86, 86:007-35(c), the decal shown below must be installed on the vehicle. Decal is included with Owner's Guide Kit located in the cab glove box.



15\_0005

#### INSTRUCTIONS FOR DECAL PLACEMENT:

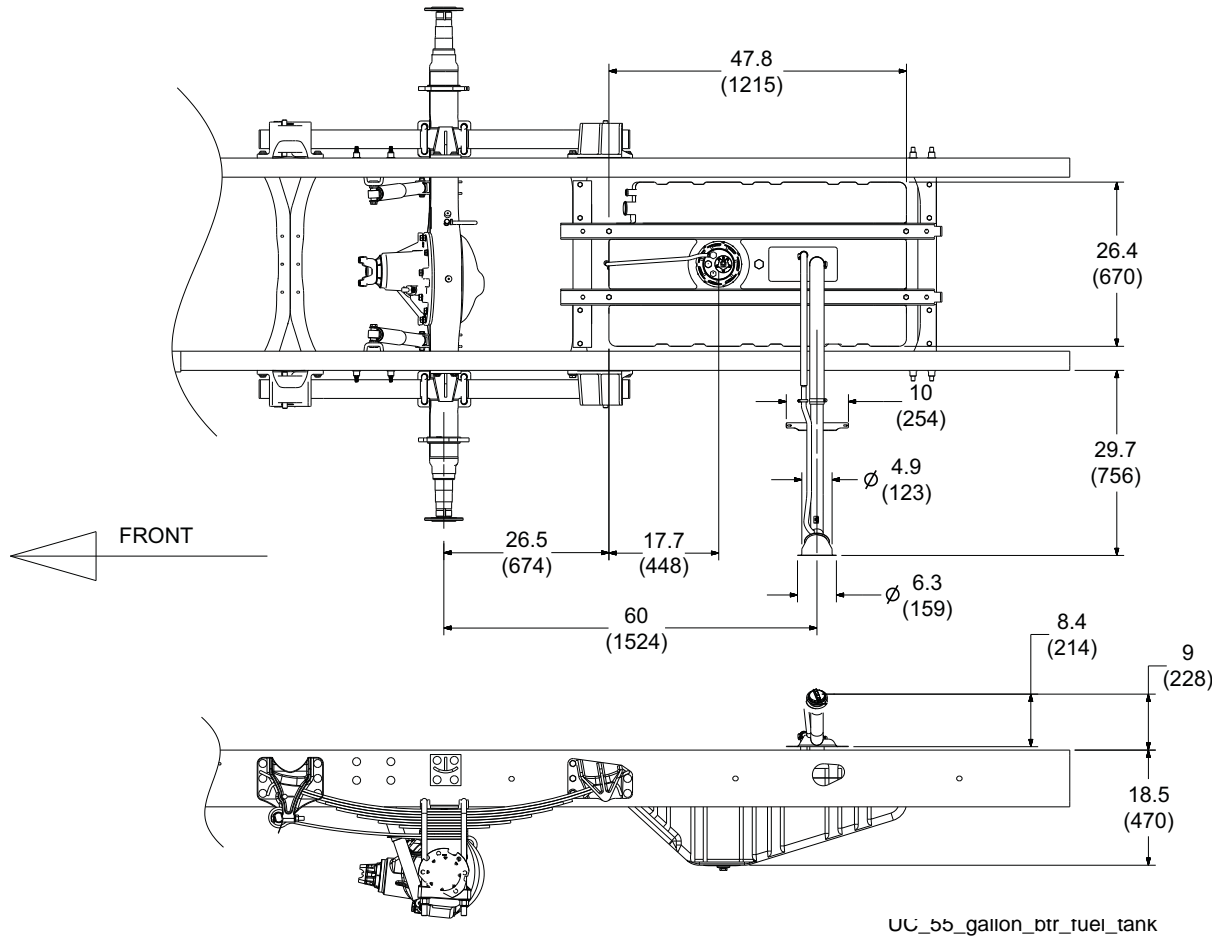
1. The decal must be placed as close as possible to the fuel inlet and be **clearly visible**.
2. The decal should be placed above or to the side of the fuel cap to avoid corrosion by possible contact with fuel.
3. The decal may be placed on aerodynamic fairings, bodies, etc. as long as the decal is clearly visible and in close proximity to the fuel inlet.
4. For installed bodies that have a fuel door (e.g. buses), the decal should be placed above or to the side of the fuel door.

Thoroughly clean the area of all grease, dirt, etc. before application of the decal. Apply the decal at room temperature, 65° to 75° F.

## Fuel Tank Location (Continued)

Code 15STY

Single Mounted Between Rails Behind Rear Axle, 55 Gallon, with Fuel Fill Tube



Per EPA Title 40, Part 86, 86:007-35(c), the decal shown below must be installed on the vehicle. Decal is included with Owner's Guide Kit located in the cab glove box.



15\_0005

### INSTRUCTIONS FOR DECAL PLACEMENT:

1. The decal must be placed as close as possible to the fuel inlet and be **clearly visible**.
2. The decal should be placed above or to the side of the fuel cap to avoid corrosion by possible contact with fuel.
3. The decal may be placed on aerodynamic fairings, bodies, etc. as long as the decal is clearly visible and in close proximity to the fuel inlet.
4. For installed bodies that have a fuel door (e.g. buses), the decal should be placed above or to the side of the fuel door.

Thoroughly clean the area of all grease, dirt, etc. before application of the decal. Apply the decal at room temperature, 65° to 75° F.

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## CAB

### Air Conditioning System Modifications

The HVAC system provided with IC Bus™ Series should not be modified. NO additional components should be added to the factory installed HVAC system as it is delivered from the manufacturer. If additional air conditioning capacity is needed, a completely independent system should be added to handle the additional load requirements of the Body Builder. There are additional costs for a second system; it would however, provide for optimal performance from both HVAC systems.

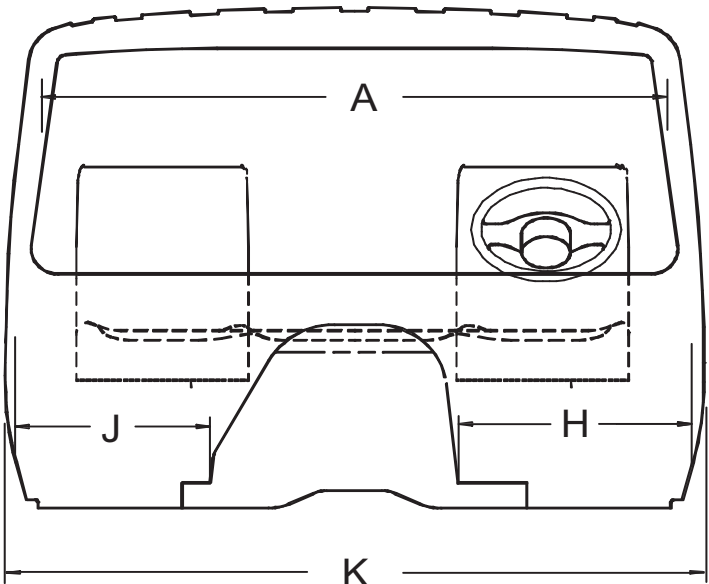
**The factory installed system cannot be modified in any manner. Modification of the HVAC system will void the IC Bus™ Warranty on that system.**

There are several reasons why HVAC system modifications are not permitted.

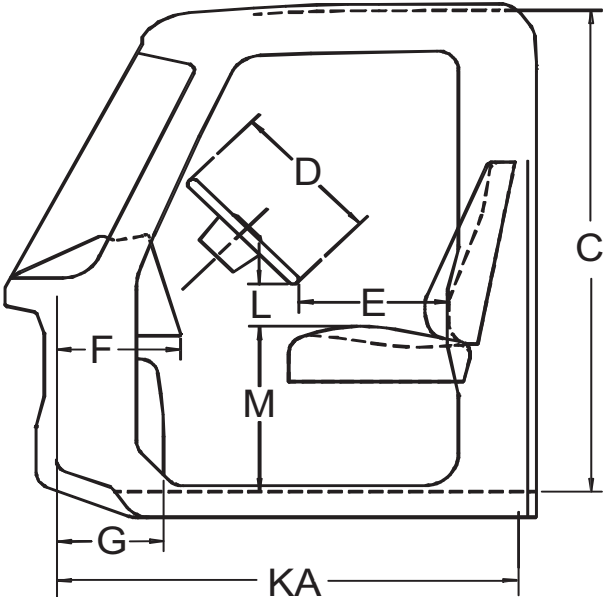
- The factory installed HVAC system is *optimized* for the evaporator, condenser and compressor combination on the vehicle. To introduce an additional evaporator (or other components) into the system will create an imbalance and unsatisfactory performance.
- The Refrigerant Control and Diagnostics (RCD) software that resides in the vehicle's body computer is designed to monitor the factory installed AC system only. Adding any additional equipment or components to the original air conditioning system will introduce conditions that the RCD software will interpret as out-of-specification conditions and cause faults to be logged.
- The factory compressor clutch is cycled by the RCD software residing in the ESC of the vehicle. Modification of this control system to add an auxiliary system could result in damage to other vehicle components.
- Since the HVAC system has been optimized for the factory components, there is no extra condenser capacity available for an auxiliary evaporator.

MODEL 4x2

Cab Dimensions



Front View



Side View

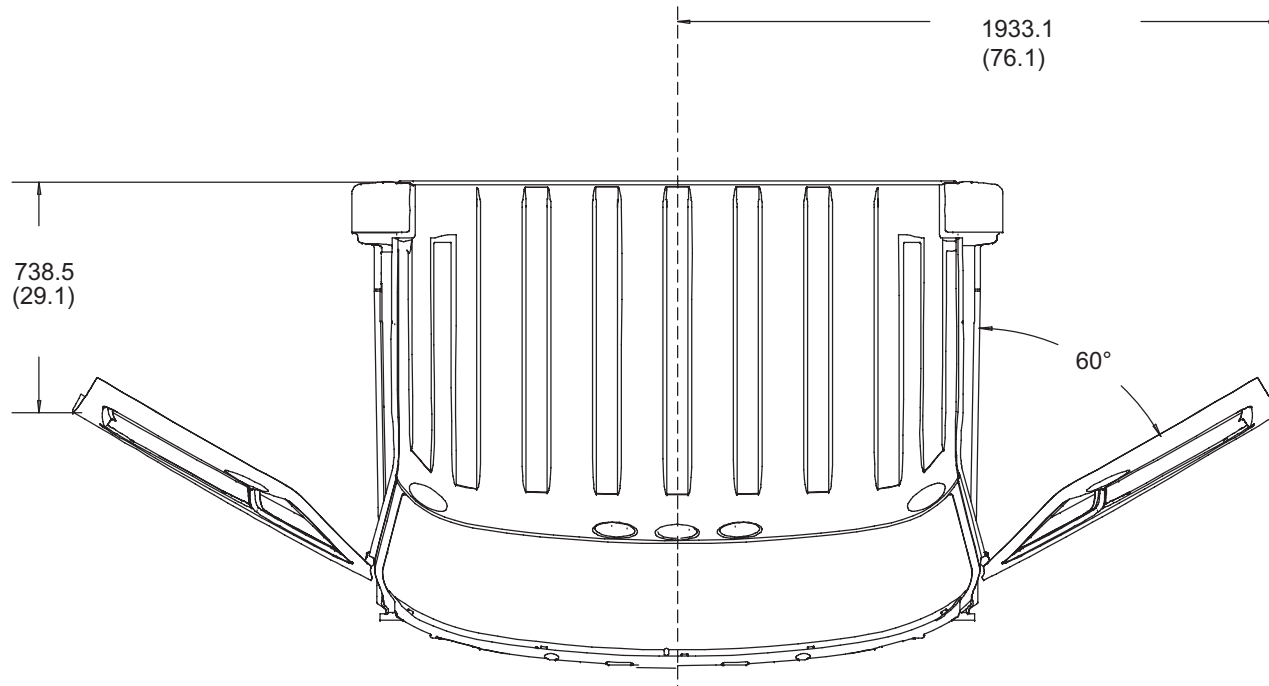
## MODEL 4x2

### Cab Dimensions (Continued)

Key	Description	Dimension – Inches
A	Shoulder Room	70.6
C	Inside Height	56.8
D	Steering Wheel Diameter	18.0
E	Steering Wheel to Seat Back (Maximum)	18.2
F	Bottom of Instrument Panel to Dash	13.9
G	Engine Cover Width	MaxxForce® 7 = 11.2
H	Lateral Foot Room - Driver	20.2
J	Lateral Foot Room - Passenger	18.8
K	Outside Cab Width	82.2
M	Top of Front Seat Cushion to Floor	19.6
–	Driver Seat Track Travel	Fixed Seat: 7.9" fore/aft Air Suspension Seat: 7.4" mm fore/aft
KA	Inside Length	52.4

## MODEL 4x2

### Door Swing Clearance

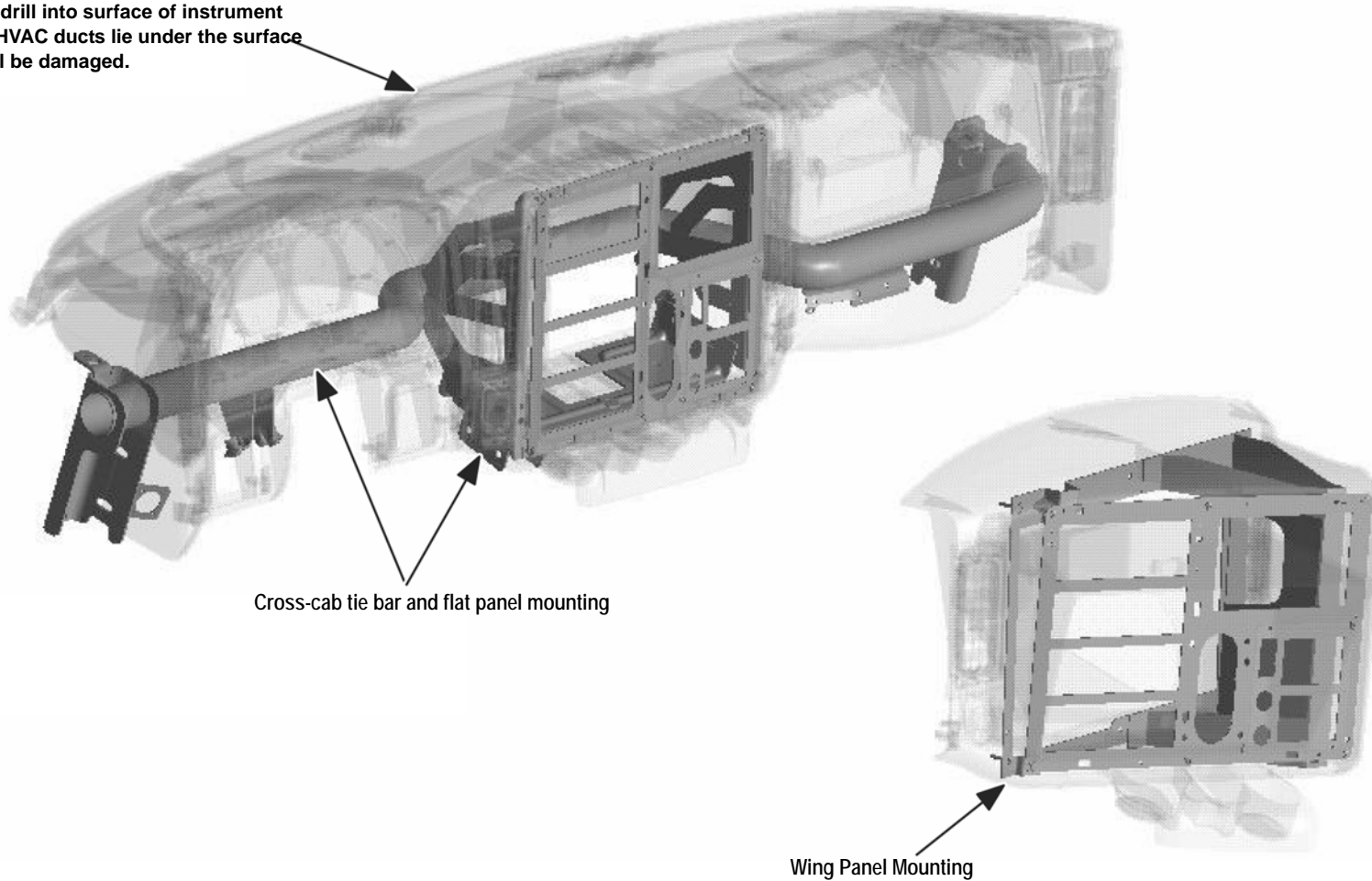


16\_0010

## MODEL 4x2

### Instrument Panel

Do not drill into surface of instrument panel. HVAC ducts lie under the surface and will be damaged.



**NOTE:** It is not recommended to add any accessory to the instrument panel. If an accessory must be added, it must be attached to the tie bar and framework.

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# 2011 BODY BUILDER



A NAVISTAR COMPANY

## UC Commercial Bus – Cutaway Bus Chassis Body Builder

PBB-39100

(October, 2011 Edition)

Order Number: PBB-39100

Navistar, Inc.  
2701 Navistar Drive  
Lisle, Illinois 60532